LECTURES ON SURGERY

AND

OTHER PAPERS

BY

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TO

THIRTY-THREE MEDICAL CLASSES

These Lectures

Are Affectionately Inscribed

PREFACE TO THE FIRST EDITION.

THE criticism of the reader who looks for a complete treatise on Surgery in this volume may be disarmed when he learns that this is only a portion of a surgical course, which includes other teachers and varied departments.

The author, indeed, has also lectured clinically, to a great degree, for thirty years; and these didactic lectures are meant to be only outlines of some surgical subjects.

In publishing these unwritten lectures, the author desires to give this expression of his obligation to Dr. Edwin H. Allen, Medical Stenographer.

BOSTON, April, 1894.

PREFACE TO THE SECOND EDITION.

Some decided changes in practice have been alluded to in this second edition of the "Lectures on Surgery"; otherwise the text remains as before.

The additional papers require no comment from me.

D. W. C.

BOSTON, May, 1898.

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LECTURES ON SURGERY.

I.

GENERAL CONSIDERATIONS.

We are going to speak of some of the general considerations in surgery, not by any means that this is your first instruction in that branch, but because as the beginning of a systematic course it seems proper to review the general subject. One might say that by the brilliancy of modern surgery, by its triumphs and by its boldness, there was danger of being led away from the first and soundest principles of conservatism, which should make one prefer to avoid an operation rather than to do it, if that were equally beneficial to the patient. Now there is a great charm about surgery, because it is visible and tangible and demonstrable, and also because we know at once when we have done right and when we have done wrong, — a thing that we do not always know in medicine. The difficulties of diagnosis in medical practice and the doubts about the effect of drugs make the practice of medicine full of uncertainties. Surgery is to some degree uncertain but not nearly as much as medicine. We know at once when we have done wrong, for instance,

These are unwritten lectures printed from the stenographer's reports. Verbal corrections are made in revision, but no rhetorical changes. They were delivered to the third and fourth classes as part of the regular course.

when we have attacked a tumor which had better have been left alone, or mistaken a fracture for a dislocation; we are conscious at once of the wrong we have done, and perhaps can correct it the next time. Our mistakes in medicine are more apt to be concealed, and we cannot learn as much from them, in consequence. I think there is no doubt that medicine requires a higher grade of intellect and more judgment than the practice of surgery. Formerly it occupied a much more advanced plane than now; but latterly surgery has been so bold and patient and successful, and has made truly such enormous advances, that it is displacing medicine a good deal in certain departments. This is particularly true, I think, in certain specialties, like gynecology, where now it is all surgery and no medicine, while formerly there was a good deal of medical, local and mechanical treatment. But surgery really is a part of medicine, and it does not demand so varied a culture to make one successful in it; and surgical diagnosis is, and should be, a great deal easier than medical diagnosis. The French give to it the name of "external pathology," pathology that can be seen, and appreciated by the touch; and although certain regions, like the abdomen and scrotum, are very obscure as to their contents when diseased, yet in many cases external pathology is very easily read and recognized. It is one of the earliest things that the student sees. He sees the displacement of a fracture, the deformity of a dislocation. He sees unnatural outlines, he feels the outlines of a tumor; neither of which can he do in medicine. This, then, is probably one of the great charms of surgery, its tangibility, and its certainty, when we succeed. We feel sure, when we have done right, that we have done a great deal of good; but equally sure, when we have done wrong, that we have made a very grave mistake.

One is tempted to think that surgery means operation. It does not necessarily mean that; and although the operative part of surgery is brilliant, it is not the best part, nor does it require the highest attributes of mind. Surgical pathology is a matter of much finer grade than surgical operations. A man with a good knowledge of surgical pathology and good judgment is more valuable to his patient than one who can amputate dexterously, because that is to a certain degree a mechanical art combined with anatomical knowledge. Not that I would depreciate in the slightest degree the importance of anatomical knowledge or dexterity, only they are not by any means all of surgery or the best part; for the knowledge of surgical pathology, patience, judgment, conservatism, are the best part of surgery.

Latterly (always, in fact, since the time of M. Louis, who first introduced the numerical method), latterly, and in all times, one has been led to rely upon statistics as showing the exact result which should be expected in a surgical disease or a surgical operation. Now statistics are fallacious. They cannot disclose to us all the peculiarities of an individual case. They are good as an average, but they do not apply to the individual. By that I mean to say that in no given case can you say: This patient is about to have such an operation done on him. There are seventy-five chances that he will recover, and twenty-five that he will die, exactly. That cannot be so accurately formulated as that. One can say safely: In the majority of such cases so many recover, and so many die. What this individual will do, he has got to prove for himself. And the reason of this uncertainty is that we have by no means mastered all the phenomena and the problems of life, all the peculiarities of the individual, all the changes in the person's constitution, all those thou-

sand influences of various circumstances, some of which we shall allude to as bearing on surgery, in the course of this lecture. You cannot say with accuracy what a man's chances are.

That brings us now naturally to the point,

WHAT IS THE OBJECT OF SURGERY?

It can have but two objects: one is to relieve suffering, the other is to prolong life. If it can accomplish either of these objects, it succeeds. If it does not seek to accomplish one of these objects, it is on a false aim; if it does not accomplish them, it fails. It may strike one perhaps, at first, somewhat with surprise that such an idea should be enunciated as that surgery might not seek always to accomplish one of these objects; and yet scientific ardor may push aside that humanity which ought to be the great moving factor in all surgical judgment. I think this is more apt to be the case among the races which are not Anglo-Saxon than those which are. I think the Anglo-Saxon mind has, for some reason, a more naturally humane tendency than the Latin mind or the German mind; and that humanity always has been the great consideration of the English school and of the Irish school and of the Scotch school, and I trust it always will be of ours. To relieve suffering or to prolong life: well, that again naturally divides operations into several classes, for they come up with more or less urgency before the surgeon according to the condition that the patient happens to be in. So we say that such an operation is an *operation of necessity;* and of another, that operation is one of *expediency;* and still of a third, if that is done at all, it can only be done as a forlorn hope and as a *last chance.*

The operation of necessity may cover such grounds as a bleeding vessel or a strangulated hernia or an appendicitis with an abscess and stoppage of the bowels — cases of that class. No one can hesitate as to the propriety of interfering and doing the best he can; and under those circumstances no one should wait, the case being urgent, for complex or minute surgical machinery; for you must remember that before the days of modern appliances, and far back in simple country life, that a great many desperate operations were done, and a great many lives saved with the simplest tools and with the rudest surroundings; so that, given a case of necessity, we must go ahead. We cannot do otherwise.

On the other hand, the operation of expediency is a far different matter, and there comes in weighing of chances, pro and con, which no man can definitely settle; and that brings us again to the fallacy of statistics. Here is where statistics come in. You say such a person has a tumor of the breast. That tumor, so far as we can make out from her age and its peculiarities and the probabilities, is malignant, probably cancer, probably the epithelial form of cancer in the breast. Its natural history is to run about three and a half to four years, and then terminate life. That is its outside limit, as a rule. If left to itself it will gradually necrose the tissues of the breast and infiltrate all the neighboring parts, break down the breast into a sore that will become very offensive to the patient and friends; it will involve the arm, cause swelling and pain and pressure on the veins, and gradually, probably, it will invade internal organs through the lymphatics, and in three to four years destroy life. On the other hand, if this diagnosis is true, and this case is operated on and the disease removed (all that we can see), the chances are that life will be prolonged, that there will be an

immunity of some months to one and a half to two years of reasonable health before the disease comes back, and that if it does come back, as it almost always does, that it may come in a locality not quite so distressing, that the patient may die of cancer of the liver or of the lungs, or some other internal part; that she may not have the deformity and distress of an ulceration, and, at any rate, that she has a year or two of peaceable life. Besides this you must say to yourself: The patient is entitled to this operation, if she wants it, on the ground of the moral effect it will have on her. If you do not do anything she will be very much discouraged and perhaps seek measures not so good as the poor ones you can offer. Here, then, comes in the question of expediency pro and con, pro and con; and the diagnosis once being made, the rest must be balanced, for the truth is that statistics cannot give you accurate facts. You can say, the natural history is so and so, it will probably go so long, probably recur in about such a time, in about such a way; but not necessarily so in this given case because there is infinite variety in the disease and in the individual.

Then there is the operation which is done as a last chance. That is a very distressing and serious problem indeed. A good many poor people come to the surgeon and wish to be executed, killed, put out of the way, and say: "I am suffering so much that if I can have some ether I don't care whether I wake up or not. It is an easy way to go, and you can do the operation; and if there is a chance of my coming through, I will take that chance; and if it goes the other way, I shall be satisfied." That is quite a common thing to have people say who have reached a certain period of life, or a certain degree of mental tension from pain. Pain is the great destroyer of happiness and peace and fortitude; and

after a while it breaks people, and they want to get rid of it at any cost. Opiates relieve for a while, but it recurs; and patients, for instance, with cancer of the pylorus, or many other cases I might allude to, are in that state that they had rather die than live as they are. Now the surgeon has to ask himself: Is there a last chance? Is this forlorn hope likely to lead to anything, or surely going to lead to death? If the latter, he is not justified in operating. If there is a chance, and the patient clearly understands it, I think myself he is entitled to have the benefit of that slight chance if he wants to.

This brings us to another very important part of the subject, that in operations of necessity and in operations of expediency and in operations which are merely forlorn hopes, in an ascending scale of prominence and gravity, comes the question whether or not any operation should ever be done *without the consent or knowledge of the patient*, or, if a minor, the patient's parents or guardians or friends. No such restraints, I imagine, hold people back in certain parts of the continent of Europe. I think they go on and do things if they think best. The law protects them. The hospital patient is very properly subjected to certain rules when he comes there, and such things as complaints and suits for malpractice are practically unknown, or very much less frequent than with us; but fortunately or unfortunately, — I am hardly prepared to say which; in the point of humanity fortunately, and in the point of the poor doctor unfortunately, — with us the accountability to which one is held for every act performed surgically is very strict, and we have to be careful to protect ourselves; not only to protect our good name, but also our pocket, in threatened suits. Hence the very great importance of getting consent for things which

are necessary. I say the importance of this consent is in an ascending scale in those three classes of cases: necessity the least, expediency in the middle degree, and forlorn hope of the last importance. In an operation of necessity, one can conceive the case, for instance, in which the patient is either drunk, or unconscious from an injury, and in which no one would hesitate to take the risk of opening his windpipe, tying one of his arteries, of trephining his head, — you must do it or he will die in a little while, — especially the first two. That is a risk you have to take, and it is well in such a case, if possible, to have some other surgeon with you in order that the responsibility may be divided, and it may be said that a consultation has been held on the case. But in an operation of expediency or where there is room to wait, it is right and safe always to wait for the consent of the parties concerned. Now you will see, when you go around about the hospitals, a great many cases that turn out badly because the doctor's opinion was not taken and his advice was not followed early in the case. Especially is this true of compound fractures and of amputations and of other cases of similar classes, where the patient holds back, refuses treatment until secondary and perhaps inflammatory changes have come on, and does not get so good a result; or even dies in consequence of this unfortunate delay. The patient who consents readily to operation, and if this is done early, in the judgment of the surgeon, has usually the best success. But we are so situated here in these American communities that we must be very careful to get full consent for everything which can be shown to be expedient. There is a large class of cases that are going to become medico-legal cases any way, no matter whether we do anything or do not do anything; if the patient dies or lives there is going to be either an

inquest or a suit for accident. Such a case, for instance, in a very marked degree, may be a case of gun-shot wound of the bowels. We see it; recognize its desperate condition; know that if there is any chance at all, it consists in doing something the first two or three hours; after that the chance of recovery is very small. We know that if anything can be done by opening the abdomen, it will be by immediately opening it in order to arrest the bleeding of vessels, check extravasation, wash out the cavity and avert possibly the onset of peritonitis, which is a very rapid disease. On the other hand, the operation is a very fatal one. Recoveries have been scanty. Its pathology, its practice, its results, are all new; and we must be very careful in cases of this class that we have strict authority for going ahead, and doing what we think is right, in cases which are going to involve necessarily criminal proceedings.

I will pass from this part of the subject, which is not quite so agreeable, to what concerns and interests us most with regard to surgical cases.

I said that statistics were fallacious, that each case had got to be considered by and for itself. There are a great many circumstances which govern our judgment in considering a case, or a patient, a good subject for operation or a fair subject for operation or a very poor subject. The condition at the time, of course, is one of the most important factors; for instance, the severity of the accident, the amount of blood lost, the degree of shock to the nervous system, — this perhaps is the most important factor of all. It is hard to estimate, sometimes. Patients sometimes look pretty well, who are apt to collapse under ether, and to die after the first few incisions are made. This is especially true of cases of abdominal surgery of an acute inflammatory nature, such as

abscess about the appendix and cæcum; or of localized peritonitis, or of irritations set up by foreign bodies, or of volvulus or intussusception, — all those conditions which are acute. Their history is the history of a few days, sometimes of a few hours. After two or three days, the diagnosis having been fairly made, the patient and friends brought to the consent of doing something by the patient's desperate condition, and the surgeon being ready, he tries *to estimate what the patient can stand*, how long it will be safe to keep open the abdominal cavity; and in this he is sometimes deceived. These patients appear pretty well during the first half-hour of ether; and then they collapse all at once, and frequently die on the table with sudden failure of the pulse and filling up of the lungs and failure of respiration. On the other hand, take the shock from the crushing of a limb from steam power or any other power, and you have immediate and intense shock. There you can estimate the situation better. You see how badly the patient is off, that he has all the symptoms of profound shock. You see at once that until he reacts and rallies to a certain degree, that he cannot bear anything more, either in the way of ether or operation; and you wait until some signs of rallying take place before you proceed to operate. The patient's condition at the time, then, in acute cases influenced by rapid disease or influenced by accidents, is an extremely important factor in surgical judgment, about when to interfere, how much to interfere, how long to interfere. The latter, I think, is the most important of all; for I believe really in these modern days of antiseptics and anesthesia we are tempted sometimes to prolong operations to such a degree that the patient sinks in the second hour who might have rallied in the first, by being kept too long in that collapsed condition.

The General Constitution of the Patient. — That is of the highest importance. Patients differ enormously. Some will live through almost anything; some succumb at the slightest blow. Some patients have what Travers used to call "an irritable constitution." He cites this illustration: One man goes out hunting, gets a slight blow on the shin. Another gets a little blow on the shin in the street. One heals instantly; the other passes into a low state of fever, and is sick a week or so with cellulitis, etc. So far as one can see, those two patients may look about alike when the accident occurs. An irritable constitution is one easily upset — perhaps you may use that word — unbalanced, not having staying power, endurance, and thrown off its true level by even slight accidents. This, I think, is more true of some races than others. I think that the Irish are an especially mercurial people, and very subject to constitutional irritation. They may recover well from operations, but operations affect them quite seriously. On the other hand, the Oriental is well known to be absolutely impassive under surgical shock, and to make wonderful recoveries after surgical injuries and surgical operations. If we have had the advantage of knowing the patient before, we can estimate what his constitution is going to do; and this, I think, is exactly what the common and much-abused saying means: that such a doctor "knows the constitution of the family"; in other words, he has seen them through thick and thin for fifteen or twenty years, and under given circumstances he can predict better than any outsider possibly could what such a one will do, if accident or disease happens. We cannot estimate it fully. We can estimate it to a certain degree.

We come to the next consideration, which we can esti-

mate, if we are careful, and that is the effect on patients who are about to undergo operations, of any form of organic disease of parts which are not about to be operated on. Take amputation of the leg, for instance, has the patient any disease of the viscera which would render an operation dangerous?

The Kidneys. — First of all, I should put the kidneys. If he has got Bright's disease, he will have his risks from an amputation enormously increased. That risk may not be enough to deter us from operating, certainly not in a case of necessity. The patient with Bright's disease, who has got a leg crushed, must have the leg taken off, and take the chances. But the woman who has Bright's disease and some tumor or little growth not troubling her very much had perhaps better be left alone. But the other condition of the kidneys, even more fatal and almost prohibitory to operative interference, is the saccharine diabetes which leads to gangrene, and leads to coma, fatal coma, serous brain, effusion in the brain under ether and after the shock of an operation. You will bear in mind that in many of the cases of gangrene you may be called upon to see in elderly or middle-aged persons, if you examine, you will find a saccharine condition of the urine. That contraindicates interference, and explains partly the cause of the gangrene in the patient.

Organic Disease of the Lungs. — Organic disease of the lungs is not quite so important. A good many people will get well if the lungs are diseased when operated on. Of course, I would not imply that an operation could be judiciously done in the acute affections of the lungs, like an active pneumonia or an acute pleurisy, anything of that kind; but in phthisis a great many operations are done, and

the patients do very well; and bronchitis more so, and so on with other chronic affections.

Organic Disease of the Liver. — Any organic disease of the liver, on the other hand, is an almost positive indication not to interfere. You are well aware that affections of the liver are apt to be accompanied with a hæmorrhagic tendency, and that that condition is very liable to crop out and annoy you in the case of any surgical operation done where the patient is really suffering from hepatic disease.

The Heart. — The heart is important in two ways: in the first place, whether the patient can safely take ether; in the second place, if the operation is on one of the extremities, whether he can nourish and repair the site of the wound after an operation is done. Usually he can. Heart disease is not a very marked contraindication; and usually the patient with heart disease can take ether provided it is given with caution, and a knowledge is had beforehand of the condition of the heart that you have got to meet with. So I should say that the heart and lungs were the least obstacles, the kidneys the greatest, and the liver the next, perhaps, to surgical interference.

Now another very important function, one that has as much bearing perhaps as any one possibly can upon the result of surgical operation, is the *power of digestion*, alimentation, nutrition of the patient, in other words, their habit of digestion, whether they have a good stomach, a fair condition of the bowels, so that the gastric digestion and the intestinal digestion are habitually carried on with a fair degree of perfectness. If they are, that patient will survive almost any surgical operation. All depends and falls back, in the long struggle for life after a severe and prostrating operation, upon the digestive powers; and if those

are good, you may hope certainly for the best results, and if those are bad, you have very little chance in contending with a severe operation.

The State of the Arteries. — It goes without saying that atheromatous arteries are the worst possible things for surgical interference. They cannot dilate and yield to the inflammatory processes, respond to the nervous stimulus of the part after it is wounded, cannot supply the vital fluid; and sloughing and gangrene take place in the atheromatous patient.

There are a good many functional disturbances I wish to speak of, that should delay an operation. In other words, they are disturbances that often can be corrected by care and previous treatment; and you will notice that the difference sometimes in certain classes of cases or patients in a series of surgical cases is as to whether the patients have been seen and prepared for it by a previous course of treatment, or whether they have been taken at once from every-day life, hurried on to the table, and in the excitement and fevered condition of every-day life operated on, at once.

Anæmia. — One of the most important functional disturbances is anæmia, bloodlessness, poor weak blood, imperfect manufacture of red cells, going back of course to the lymphatics again and to the last stages of digestion. The anæmic patient will die sometimes from shock, or from a very slight secondary hæmorrhage after an operation. Things which would be trivial to the person in fair health are sometimes fatal to the extremely anæmic person; and that has to be very carefully borne in mind; and, if possible, you should wait and build up the condition before you attempt an operation. I admit that this is sometimes impossible. For example, an anæmic person constantly losing

blood from internal hemorrhoids may be losing strength faster than you can possibly give it by delay and giving iron, tonics and food; but if there is no rapid waste going on, it is safe to wait a fortnight, and get the patient into a better condition, before you proceed to interfere.

Menstruation. — Menstruation is a poor time to operate. It wakes up a great many nervous sympathies and excitements; leads to congestion of the breasts — certainly a poor time to operate on the breast; leads to congestion of the pelvic organs — certainly a poor time to operate on the rectum, or parts in that neighborhood.

Pregnancy. — Pregnancy is rather an open question. It used to be said, "you must not operate in pregnancy at all." Now a great many severe operations are done in the pregnant state. Every one will admit if you can avoid an operation in the pregnant state, do so. If you are driven to it, with how much hope may you look forward to a good result and to avoiding abortion? Statistics and papers written recently rather tend to show that the danger of miscarriage and the danger of death in operating in pregnancy have been overrated, and patients will go through a great many things and still continue to carry the child, to preserve the life of the child and recover. Never operate if you can avoid it, but you may be driven to it by the contemporaneous presence of a pregnant uterus and rapidly growing cyst in the abdominal cavity. Both cannot go on together. One has got to be taken away before the other can fulfil its function. Probably the reason why we have less risk to contend with in pregnancy now than formerly is in the use of antiseptics. The pregnant condition has always been recognized as one of plethora, and one very prone to inflammations. If then antiseptics were not used, peritonitis was

very apt to be excited by surgical interference in the pregnant condition. In the treatment of the present day, antiseptics being used, the chances of sepsis are very much diminished, and the chances of operating during the pregnant state very much improved. Probably that is the explanation of it.

Certain constitutional conditions, for instance, typhoid fever, are very fatal in operations. Most patients who are obliged to be operated on in the typhoid state die even from slight operation. We can, of course, only conceive of a limited class of cases that must absolutely demand operation. I will not allude to the chance of doing anything in the abdominal cavity when perforation has taken place from ulceration of the ileum in the typhoid state, because that is too doubtful to talk much about at the present time. I will allude to such cases as I have seen occur, as strangulated hernia in typhoid fever, the patient getting out of bed in a state of delirium and forcing down the hernia, and having all the symptoms of strangulation while in the third or fourth week of typhoid fever; or an accident, that the patient may be subjected to in the typhoid state; those cases may absolutely require an operation. You must do it. The patient will probably die, but there is nothing else to be done.

Hectic Fever. — That is a poor condition, but yet it is one in which the patient will endure an immense amount. It is a well-known fact that pathological amputations, those that are done for disease, for chronic disease of the joints and bones, long-continued cold abscesses, things of that kind, those operations called secondary and pathological operations, have a larger percentage of recovery than those which are done primarily after the receipt of an injury when the

leg is clean and whole and the constitution fresh. This remarkable condition of things has not yet been wholly altered by the introduction of antiseptics. The balance, I think, is not so positive as it used to be, but still rather inclines to the pathological side; and the patient who has been sick in bed four or five months or a year with a diseased knee, subject to hectic, exhausted by suppuration, stands a much better chance of recovery than the patient who has just had a limb crushed; so that hectic is not a contraindication to interference. Patients who have been through the hectic stage will stand a great deal usually in the way of operative interference.

Alcoholism. — That is one of the worst things we have to contend with. It is, of course, as we will see later, of two forms: one, the man who is constantly indulging in violent debauches; and the other, the man drinking steadily every day without ever getting intoxicated. In the first case the man passes on into acute delirium tremens. In the second case, having been an habitual drinker, without excess, so-called, he probably has for years deranged his powers of endosmosis and exosmosis to an irremediable degree. The delicate membranes of the brain, of the liver, of the mesentery become changed by the prolonged use of alcohol, — damaged, thickened. Absorption of endosmosis and exosmosis, that incessant flow of nutritive and waste currents, becomes impeded. The veins become dilated. He deposits fat all over the surface. His skin becomes diseased also; all his organic functions are torpid; and proportionately he does badly after a surgical operation. We never should choose the acutely alcoholic stage for an operation, if it can be avoided; but unfortunately the same debauch that causes the alcoholism causes the accident that calls for

interference. But it is not a desirable condition in which to interfere at all, inasmuch as delirium tremens is the most common result.

Age. — This is very important. Infancy is a good time for operations. Childhood, if you will limit that time from, say, five years old to puberty, is the very best time for operations. Children will recover from most extreme mutilations and accidents, repair great surfaces, grow cicatrices where the adult cannot do it, survive lacerations and bleedings and mutilations which the adult cannot do. The power to resist injury, the power to repair is cotemporaneous with the period of growth and decreases in proportion to its decline. During the time of growth the child and the young person are certainly keeping up the balance and making an immense addition every day. Let them be hurt: their growth will be checked a little while, but this great force is thrown to repair. Growth once done, reparative power grows less; and grows less and less throughout life, until in old age it becomes, as we know, extremely feeble. Infancy to a certain degree, childhood to a very marked degree, adolescence still to great degree, middle age to fair degree, old age to a feeble degree, respond to the great strain thrown upon the system by a surgical operation or an accident.

The processes of change and repair and the course of shock vary also very much at different ages. In the old person shock is very slow in coming on, and it is very slow in going off. It may not show itself much for some hours; when it comes, it persists three or four days. The old person will lie in a feeble state three or four days in a condition that would kill a younger one, and slowly rise out of it and recover. The prognosis is not in old persons to be compared to the prognosis in the person who is thirty-five or forty. In

the old person shock is profound but slow, and may be rallied from in a condition in which we should not expect it to be in a younger person. In exact proportion to youth is the rapidity of shock and of reaction and of the inflammatory processes. In the baby the circulation and nervous forces are as active as they are in the insect you see flitting about with incessant fluttering of wings in the hot summer day: breathing, pulse and everything are rapid, and the changes are proportionately quick. This applies just as much to the diseases of children as it does to the surgery of children. A sick baby or sick child is going through its stages of shock, inflammation, and its reactions, its recovery or its death, and is going through the stages of its acute disease, in a few hours, instead of a few days.

What shall be done to prepare a patient for operation? Of course, attend to the digestive system. Give such a cathartic, if necessary, that it will act upon the whole alimentary canal, liver and other parts included, of which the best probably is the compound cathartic pill of the United States Pharmacopœia, which contains a small percentage of calomel and a good many drastic drugs. Clear out the alimentary canal, get the stomach into a fair state. Give iron and tonics, if necessary. Mental effect is very great. Here it is sometimes that the offices of the church have great effect on the patient, and they should always be estimated at their true worth, I think, in quieting apprehension and in adding to fortitude and making the patient willing and perhaps even happy in the prospect of an operation. I have seen the effect very marked indeed. If the patient desires anything of that kind, it should be encouraged, not only from motives of humanity and religion, but from scientific reasons also.

Habit. — That is a great factor. Get the patient used to things before you begin. I think it is sometimes of great value to get the patient to go to the hospital, if the operation is one of expediency, and lay off two or three days before the thing is done. He gets accustomed to the air, the room, the bed, gets acquainted with the nurses. We all know if we change our habitation or move away a little distance for a few hours into a new set of surroundings, that the effect on mind and body is quite marked even in a state of health, and the digestion and the sleep, etc., are very often a little deranged even by the slightest changes. That is especially true in the feeble nervous condition of the patient who is sick or is going to have an operation; and it is of great value sometimes to give a patient the habit of a place and familiarity with the nurses and the surgeon before the operation is done.

Absolute rest, also, sometimes in connection with this — or habitude, as I call it — is invaluable. This is especially true sometimes of operations about the pelvis and rectum; and I think it is true, perhaps not to the same degree it used to be, of operations about the joints. For instance, if you are going to do an operation which will require the limb to be done up in a stiff bandage afterwards, the irksomeness of the confinement will be great to the patient if he has not been accustomed to it, and I have sometimes thought that great gain has been got in the condition of the nervous system before operations on joints by putting the patient to bed and applying a splint for a week or so until he gets thoroughly used to that sort of condition, then after the operation if a bandage is put on he gets back to his habitual state, it is nothing new, and he doesn't fret and twist about and ache as he would otherwise do. We see this also in all

surgical accidents, such as broken bones which do not require any operation. The patient with a broken thigh, put on his back, his head tipped down, his back aches furiously about two or three days, and after that he is perfectly comfortable. It is habit. Such a condition is important to establish in a patient before a severe surgical operation.

Modern surgery, I think we all know, has made its great gain by the introduction of anæsthesia first, and by the introduction of asepsis in these latter years. Nothing can be greater than the benefit conferred by anæsthesia, but the benefit conferred by asepsis also has perhaps been equally great, and it is, it seems to me, fully as great a discovery as the other. The surgeon is emboldened now, perhaps, a little too much. He is tempted to look in and see what is the matter by an incision, when in old times he would have contented himself in palpating the abdomen and trying to balance the probabilities in his mind as to what there might be beneath. I have no doubt that the gain in surgery by asepsis has been very great; and yet I have sometimes been led to think that surgical operations are a little overdone on that account, some done that need not be done; that the impunity to the surgeon given by asepsis is the cause of what I would call his rashness.

II.

ANÆSTHETICS.

SURGICAL anæsthesia is the subject of to-day's lecture. By this we mean the power of producing, at will, unconsciousness to pain during surgical operation.

There are two kinds of anæsthesia: One is local, one is general. In the first case the patient does not lose his consciousness, in the second he does. Local anæsthetics are far preferable to any others. They are, however, unfortunately of imperfect application, and uncertain action. On the other hand, the general anæsthetic necessarily narcotizes the brain as well as the rest of the body, throws the patient into profound sleep, from which the recovery is quite slow, and sometimes quite unpleasant. The benumbing effect of a ligature or tourniquet was, perhaps, the first application of a local anæsthetic. It is quite effectual in amputating a limb. Probably if a tourniquet, or rubber twist, is put around a limb tightly and left for some little time, sensibility during the operation is very much diminished. The next that was used, and which, for a while, was quite popular and quite effectual, was freezing the skin over a limited area in order to abolish its sensibility. Any agent which evaporates rapidly and produces cold will do this. Alcohol will do this. Ether will do it better. The higher grades of petroleum oils will do it better still: and from them was manufactured an agent which was called rhigolene by the manufacturer, which had a very quick evaporating power, and produced an intense

degree of cold. The disadvantage of the anæsthesia produced by cold is that the local freezing must be followed by a reaction, and that when the reaction comes on and the vessels fill again with blood, the same tingling and pain is produced as is done after any other mode of freezing. This, added to the wound which is made by the surgeon, to all appearance, produces more intense suffering in the patient than the original relief afforded by the freezing operation. Secondly, although the rhigolene is very useful in certain cases, it is not capable of a very extended application. It may be used for a felon; it may be used very nicely indeed for a puncture, as for instance, paracentesis of the thorax or the abdomen,— over a limited space and for a short time, so that the reaction that comes on will not be too painful and too severe; but this is the limit of its application.

In the discovery and use of cocaine as a local anæsthetic we have the next best example, and the best one that we have now. Cocaine applied to the mucous membranes is quite a good local anæsthetic. It seems to affect more sensibly the eye and the mouth than it does the urethra and the rectum, probably because it is more perfectly applied. It is not, however, of much use when applied to the sound skin, and in order to produce a local anæsthesia upon the true skin, if you wish to make an incision, you are obliged to inject the cocaine solution subcutaneously into it. It has a great power in shrinking up the blood-vessels. It will drive the blood out of the parts temporarily, and in that way has quite an advantage in some minor operations, such as those about the eyelid, the interior of the nose, throat and gums. It has no special action apparently upon the parts themselves except this, that when injected subcutaneously it frequently gives rise to quite a rapid œdema of the tissues. Injected into the

cheek for instance, to cut out a wen or a pimple, it produces a puffing up of the cheek which lasts for an hour or more, and may be an embarrassment to the patient, and to the surgeon, unless he works speedily. Constitutionally, however, upon the other parts of the patient it does have quite a serious effect, and that effect is its specific one of a narcotic and a depressant to the heart; so that it is not always a safe agent to use in feeble persons. Had I a patient with a very feeble heart and a general condition of anæmia, I should think it safer to give him ether to breathe than to give him strong injections of cocaine under the skin. Several fatal cases have occurred. I think the statement has been made that it is not safe to *inject* more than one-half or two-thirds of a grain; but it is ordinarily used, a few minims at a time, in a four-per-cent. solution, upon the mucous membranes.

General Anæsthetics. — Of the general anæsthetics, which affect the whole body, we have sulphuric ether; we have chloroform; we have the nitrous-oxide gas, as it used to be called; and we have the bichloride of methylene; we have various compounds of ether and chloroform, chloroform and alcohol, chloroform and the various essential oils, etc., which are called mixtures. The two great types of the class of general anæsthetics, of course, are sulphuric ether and chloroform; and the others are either more uncertain or more brief in their action than these two typical ones.

In very old times, as far back as the Greeks, the hellebore and various other drugs were used to produce insensibility to pain in surgical operations. Later, opium was used. Later, and even down to the present time or quite recently, alcohol has been quite largely used; and getting the patient intoxicated with alcohol certainly had a certain amount of effect in benumbing him to the pain of an operation.

It was in 1846 that the great discovery was made that sulphuric ether, if breathed, would produce insensibility to pain, and was not especially dangerous to life. That marked, as we all know, a great era in surgery. It was in the following year, if I am correct, that chloroform was discovered, and substituted in many countries for ether.

The advantages of anæsthesia to the patient and to the surgeon are so obvious that it is hardly necessary to dwell on them. To the patient the boon, of course, is invaluable. The result of anæsthesia has been that it has enlarged the domain of surgery very much. A great many more operations are done than formerly. A great many more patients will consent to operations than formerly. The great dread of the suffering from the knife is taken away; and it has become now so customary to give it that it is regarded as a matter of course. The advantages to the surgeon are equally great, because it enables him to operate upon an insensible subject, without haste, without feeling, without motion.

These two great anæsthetics, ether and chloroform, have each their peculiar characteristics. Ether, for instance, is bulky and disagreeable and light; and chloroform, on the other hand, can be used in small amount, is pleasant to take, and is very heavy as a gas. Ether primarily acts by stimulating the circulation and the heart, and producing an overaction of the pulse, and a species of intoxication, followed by narcotism. Chloroform, on the other hand, acts at once on the respiration, and on the heart, rather depressing the action of the heart; quiets down the patient, throws him into a pale, uncolored sleep without excitement, and is a much pleasanter anæsthetic to give and to take.

As regards their danger, it appears to be pretty well

proven, that about one person in twenty odd thousand who takes ether may succumb to its effects and die; and one in about every two thousand who takes chloroform may meet with a fatal result. Chloroform, then, to look at the matter impartially, is apparently about ten times as dangerous as ether; and in this country and especially, I should say, in this community, where perhaps we may have been influenced somewhat by the fact that ether was discovered here, we hardly consider ourselves justified in giving chloroform when ether can be as well taken, thinking chloroform so much more dangerous. In some other parts of the United States, in the Continental countries of Europe, and, to a considerable extent, in England, chloroform is still largely used in preference to ether. There are certain operations which are adapted to the one, and not adapted to the other anæsthetic; that it is fair to say. Ether is very inflammable. The gas is volatile and catches fire with great facility in the air. On the other hand, chloroform is not inflammable. A match can be dropped into it and not catch fire; and it is therefore much safer to use in operations anywhere near the breathing apparatus when the cautery is to be used. Accidents have happened from the lighting up of ether in the throat with fatal effects to the patients. Fortunately they have been very few; but they have occurred. On the other hand, such an accident as this is impossible with chloroform; and for the patient who has got to have the actual cautery applied about the antrum, inside the mouth or throat, the proper agent to use is chloroform; or if ether is used, then considerable care must be taken to wait a little while after the patient is perfectly asleep, until the ether has been moderately well exhaled; then to fill the parts about the throat temporarily with a wet towel in front of the cautery, and to apply

the cautery over that, so that the fumes of ether, if ignited, may not be inhaled, and at worst can only burn the outer surface of the mouth. Ether is more suffocative to the patient than chloroform. Chloroform is the preferable anæsthetic to give, I think, in performing tracheotomy, if any anæsthetic is used. The child is not so alarmed at the little thin cloth or napkin held at a distance from the face containing a few drops of chloroform as he is at the ether inhaler. Chloroform, then, in this condition is taken more pleasantly, does not produce that spasm of the glottis that ether does, and therefore is not so dangerous in doing tracheotomy. It also has one other advantage, that it is not so liable to produce that congestion of the mucous membrane of the bronchial tubes which leads to the excessive secretion of mucus, frothy mucus, in a good many patients who are taking ether.

There are some conditions where neither anæsthetic should be used; when it is not safe to use either. One of these is in the operation upon the chest when we tap it for an effusion, any of those conditions in which one lung has been disabled and doubled up and crumpled away under the pressure of the effusion; the patient breathing imperfectly with the other lung, and if then subjected to an anæsthetic, he is easily suffocated even during the brief operation; and it is now recognized, I believe, as wiser not to give ether at all, or chloroform, during operations upon the thorax attended with effusions. Rhigolene or cocaine are sufficient for the punctures and incisions which are sometimes made in that region. With this exception, there are few conditions in which ether cannot be safely given. Ether can be given safely even in quite an advanced stage of pulmonary consumption. It can be given, with care, in heart disease; and

even in conditions of extreme debility, if it is not carried on too long; its earlier effect being stimulating, and its later effect prostrating. On the other hand, chloroform cannot be safely given to any patient with a weak heart, or with valvular disease of the heart; and that restriction certainly would have to be made. We are left then with the fact, so far as statistics have proved anything, that ether is a safe anæsthetic; that it is very difficult to kill a person with ether; and when you go about in our hospitals and see the freedom with which it is used you perhaps wonder that more deaths do not occur. On the other hand, it is also quite well proved that chloroform is quite a dangerous agent; and on that account its use has been abandoned in a good many communities. It is impossible to warn against its danger. It is impossible to foresee its danger. Its action, when fatal, is almost instantaneous. The bringing-to of a patient after he is narcotized with chloroform is rare. The bringing-to of a patient after he has ceased to breathe for a moment under ether is common; and the reason is this, that chloroform is a very heavy gas. It is exhaled from the lungs with difficulty. If it is inhaled it drops down into the air cells and lies there until it slowly acts upon the blood, is changed, and undergoes chemical absorption, probably, rather than immediate exhalation from the lungs themselves. On the other hand, ether is so light and volatile a gas that it cannot get into the lungs until it is largely mixed with atmospheric air in entering. It is easily exhaled, and it takes a much longer time to load up the system with it than it does with chloroform. Chloroform then is a heavy, paralyzing agent which lies in the air cells, undergoes chemical changes, has an immediate effect upon the circulation, and overwhelms fatally and speedily the feeble heart. Ether, on the other hand, is like

taking alcohol. It is an arterial stimulant. Its early effects are to redden the face, flush the cheeks, stimulate the heart, throw the person into a perspiration, make him drunk, exhilarated, to carry on every vital function for a few minutes in more activity than in health. It is therefore a stimulant first before it is a narcotic. Chloroform is a narcotic from the beginning and may overwhelm the feeble person. It is impossible to estimate that class of patients with justice who are said to have feeble hearts. We hear perhaps no abnormal sound on listening. We may recognize the fact that although the heart is beating with regularity, it is not beating with any great force. We cannot tell how much of it is due, however, to mental apprehension at the moment; or how much it may be due to other causes. It is impossible to estimate just when you have got to do with one of these very feeble hearts; and it is precisely this class of cases that ether is safe for, and chloroform fatal to. A few whiffs of chloroform, and perhaps such a patient has no action of the heart; and if he revives, he revives slowly. On the other hand, if he takes ether, he has the heart stimulated, and is, in reality, after five or ten minutes of etherization, in a safer state as regards undergoing any shock than he was before he took the ether at all. These, I think, are the great and important distinctions between the agents. The person in ordinary health and strength undoubtedly runs but little risk in taking chloroform. It is pleasanter, more comfortable, more convenient. How many deaths occurred under it on the field of battle we never shall know; probably not a great many. During our late Civil War, when the number of wounded and those who took anæsthetics was so enormous, chloroform was almost the only agent used. Chloroform must always be the agent used in

war, because ether is too bulky to be transported. Four, six or eight ounces of ether are often consumed for a single case, sometimes as high as a pound. On the other hand, a drachm or two of chloroform will do the same amount of work. Chloroform in military surgery, in strong and healthy people; the same agent in cases of tracheotomy, is, and always will be, useful. But if we can have our choice, in the average of mankind, average of health and average of strength, we shall feel, with ether, ten times safer than in using chloroform. I think we have taken quite long enough for the discussion of the comparative merits of the two agents; but I wish to lay this down pretty strongly, because every few years quite an outcry is made about the danger of ether or of chloroform; and recently the London *Lancet* has conducted an inquiry for which it has sent here, to all our hospitals, for statistics as to the relative merits of the two agents. We need not be afraid of chloroform in the reasonably healthy person; but we should prefer to use ether when we can, as being ten times more safe. Ether *can* kill people however; and very easily, if we have a little neglect.

Essentials in the Administration of Ether. — The essentials in the administration of ether are these: that the patient should have a reasonably empty stomach, that he should have unrestricted room in which to breathe, and that he should be put in a position where he will not be likely to drop off faint suddenly from exhaustion, if that comes on. These three conditions are met by giving the patient nothing to eat for some hours before the operation; by seeing that the clothing about the neck, about the thorax and especially about the region of the diaphragm and waist is thoroughly loosened, and by putting the patient in a position either reclining, or at an angle of about 45 degrees. On the side is

an excellent position in which to take ether, the reason being that the tongue falls naturally forward and the secretion of mucus rolls out of the mouth easily without suffocating the patient. The danger of having food in the stomach has been so often insisted on that it seems almost idle to speak of it, but cases of suffocation occasionally occur in which the patient, being seized by an attempt at vomiting while asleep with ether, having lost control of the epiglottis, is suffocated by the entrance of food into the larynx. Food in the state about to form chyme is most dangerous, because thick and pultaceous and pudding-like; it is not thrown out in masses in vomiting, but merely regurgitates over the epiglottis and so fills the larynx. Of course it goes almost without saying, that all foreign substances should be taken out of the mouth; and this is especially true of artificial teeth. Emptiness of the stomach, loosening the clothing and an easy position, — those are the great requisites. It is a good plan to tell the patient to close the eyes, if he can be induced to keep them shut, because ether is quite an irritant to the eye, and he will wonder the next day why he has got a slight degree of irritative ophthalmia from the ether.

Dangers in giving Ether. — The dangers in giving ether are of several kinds. They are quite distinct from those of chloroform. The danger from ether is danger of suffocation; and the danger from chloroform seems to be from its effect upon the heart. The first signs of danger from ether are usually shown in the breathing, and in the effects of impeded breathing upon the blood. On the other hand, the first signs of danger from chloroform are shown in the pulse, and the pallor of the skin. The ether patient, if he gets into a dangerous condition, becomes suffocated. He ceases to have a bright arterial color; does not grow pale, but blue, livid.

That is especially true of the ears and the finger-tips and the skin about the forehead, which can be easily watched; and if this purplish hue comes on, it is a sign that slight suffocation has taken place. There is too much ether, too little air; and the removing of the sponge, of course, promptly does away with this difficulty. While breathing quietly with ether the patient may suddenly become choked up, apparently without any cause. A little examination will reveal the fact that the stertorous condition having been reached, the palatine muscles and muscles about the throat having been paralyzed so that the tongue is no longer held forward by the genio-hyoid and hyoid group in front, it drops back upon the larynx, and suffocation takes place merely by its pressure backwards. That is very easily relieved by drawing the tongue forwards; and it should be drawn forwards in front of the teeth so as to project beyond them; or by partially disarticulating the lower jaw over the *eminentia articularis* by putting the fingers behind the angle of the jaw. This we cannot do readily in the waking state; but, when the muscles are paralyzed under ether, the jaw slips very readily forward. That you will see opens the glottis, and throws the tongue forward without the necessity sometimes of doing anything more. If this is not sufficient, the tongue is seized and drawn out of the mouth. The position of the etherized patient upon the side is the great safeguard against the occurrence of this falling back of the tongue.

The next peril that comes on, sometimes, is the excessive secretion of frothy mucus. This occurs only in a limited number of subjects. It is extremely annoying; it delays operation, delays the progress of ether, and it is also dangerous. The bronchial tubes become filled with this secretion; the mouth and throat become filled with it. Although wiped

away, it continues to form; and the patient breathes with a constant gurgling through this mass. Ether produces this effect; chloroform does not. It has to be carefully watched. Ether is to be suspended, taken away, and time given for the perfect aeration of the blood; and the patient must have his throat swabbed out before the ether is reapplied.

Sometimes a peculiar tetanic setting of the muscles of the thorax occurs, which is extremely dangerous and it occurs instantly. The patient may appear to be breathing well, and although his tongne is out and the mouth open with plenty of room for the entrance of air, he instantly sets the thorax in a tetanic state, and ceases to respire. This dangerous condition is best relieved by allowing fresh air to come in, and by going through the movements of artificial respiration, rhythmically, to restore the action of the thoracic muscles.

Sometimes the patient appears to be breathing with great vigor and energy, without any noise, and yet he is growing purple. You are at a loss to explain this until you look at him. You see the diaphragm going up and down with great vigor, and he apparently is breathing, but in reality is not getting a particle of air into the lungs. This is the condition of closure of the glottis, and the diaphragm is still keeping up the pumping motion, but pumping on an empty pair of lungs. As soon as the trouble is recognized, it may be relieved by removing the ether.

The deaths which have occurred under ether have more frequently occurred in operations upon the lower extremities, or more especially upon the pelvic organs, the reason being, apparently, that the surgeon is far away from the face of the patient, that he does not have an opportunity to see what is going on, does not recognize at the moment that respiration has ceased. This, however, ought hardly to occur to one

who is careful in operating about the pelvis and perineum, because the *levator ani* muscle is so perfectly antagonistic to the diaphragm that it moves with the diaphragm in all steady and forced respiration; and in operations about the outlet of the pelvis we have only to look at this muscle directly before us, to see and count exactly the respirations going on.

When danger arises in the inhalation of ether from any of these causes the respiration ceases first, and, afterwards, if time enough has elapsed, the pulse. Most of these cases are readily brought back to life by taking away the ether, clearing out the mouth, drawing forward the tongue, opening the windows and admitting air, and by the use of artificial respiration by the Sylvester method. That, continued carefully and not too rapidly, generally speedily restores the respiration. The danger in using these artificial means of respiration is that in our haste and fear we are apt to make the motions too rapidly. They should be made only about sixteen to twenty times in the minute, so as to imitate the natural rhythm of respiration; and if made hurriedly the effect is practically destroyed. We do not give the lung time to fill thoroughly, and the air to be expelled, before we try to fill it again, with these rapid and imperfect efforts. Electricity, the application of cold and heat to the nerve centres, etc., have been used with some benefit; but the taking away of the ether, admission of plenty of fresh air, sometimes the subcutaneous injection of brandy or ammonia, and artificial respiration first, last, and always, are the safeguards in giving ether. Usually the careful surgeon sees danger when it is coming, and is able to prevent it, by prompt measures, before it has occurred.

Ether is a stimulant for a while, but it is not so long; and here arises one of the dangers, I think, of anæsthesia; and

especially, I may say, in the modern surgical methods and dressings that operative procedures are so much prolonged that I think danger arises from the prolongation of the anæsthetic state. Ether when given acts exactly in this way: at first it starts all the machinery with more vigor; the heart acts more forcibly; the pulse beats stronger; the skin becomes warm; a little perspiration starts out; the patient is exalted in mind and body. Every function goes on for a few minutes with increased vigor; then the narcotic effects come on, and the patient sinks into a quiet sleep; a little further on, and comatose sleep comes on, in which the respiratory centres are affected by the action of the narcotic, and he snores and is perfectly relaxed. His cornea is entirely insensible to touch; his skin sweats profusely; and he lies in a perfect state of relaxation and coma. This condition may be kept up with safety, as regards life, for a considerable time; but after the first half-hour there begin to appear certain signs of slight collapse under the continued effects of ether. This is manifested by increasing rapidity of the pulse, which begins to mount up slowly, a few beats at a time; by shallow respirations, which are often quite marked; by drenching sweats, which come out on the patient so as to run off the face and neck in streams; and by cool extremities. Etherization prolonged in this condition and to this extent during the third half-hour produces still more markedly all these symptoms of prostration; and when the patient has reached the stage when the slightest amount of sighing respiration begins; when the respiration instead of being regular, although shallow, begins to mark an irregular measure, then a period of great danger has come on, and the time for totally suspending the ether, and for stimulation, heat, etc., has arrived. Ether the first half-

hour is only a good agent; the second half-hour it is tolerable; the third half-hour it begins to be dangerous in its effect upon the patient. Now, of course, we have got to consider how much the relief of shock to the patient from not feeling the pain of an operation may be compensated for, or rather I should say its good effects done away with, by the fact, that a very prolonged etherization may lead to secondary prostration and collapse, and secondary shock from that cause alone. In other words, we can give patients ether, can put them to sleep; they will not feel our cut at all; they will be spared the terrible agony of the knife, of sewing up and sponging out the freshly cut wound; and will always remain ignorant of that shock and injury. So much saved. The secondary shock will come on from having had the ether kept up so long that the patient sinks into a state of dripping perspiration, feeble and rapid respiration and cool extremities. Ether or any complete anæsthetic, it is safe to say, diminishes the shock of an operation; but it cannot be said that it does away with the shock following an operation. Take such an example as this: a prolonged and serious operation on the abdominal cavity, whether for tumor or gunshot wound, or any such cause. Ether enables the patient to be put to sleep and have this terrible series of processes carried through without consciousness. It does not prevent the secondary shock coming on afterwards of having had his viscera exposed, the peritoneal cavity opened, his intestines handled, the delicate sympathetic nerves in that part exposed to the air and touch, and therefore he does not escape at all the secondary shock; he has that just the same as if he had not taken ether at all. If to all this is added the fact that it may be necessary to keep him long under the anæsthetic, then you have added

the prostration of the agent you are using to the effects of the operation. I would not be taken to mean for a moment that I would not give ether in all these cases. I wish to point out the fact that it is possible to kill with it; that it is not an unmixed blessing; that it should be regarded as a powerful agent for evil as well as for good; should be used with great care in surgical operations; and should be used just as short a time as you possibly can.

Primary Anæsthesia. — This consists in that moment of temporary unconsciousness which comes on after the patient has taken five, six, eight or ten strong inhalations of ether before he passes on to the period of excitement. He takes the sponge, breathes two or three times, is told to breathe more strongly, give five or six forcible respirations, does not get red and stiff, but is temporarily narcotized, and at that moment a simple operation can be done without his feeling it or shrinking, and he will wake up the next moment totally unconscious of what has taken place. Complete anæsthesia, on the other hand, is when we push it to the extent of coma and stertor, in conditions where we must have absolute relaxation, as in reducing dislocations, and in prolonged operations.

It is a very curious fact that those who are in the habit of using alcohol largely are very hard to etherize. This is familiar in all hospitals. The drunkard will take an immense amount of ether before he will go to sleep; and sometimes it is almost impossible to get him thoroughly quiet. Another condition also arises in these excitable subjects, which is an uncontrollable muscular tremor, which persists after they are really unconscious and asleep. This sometimes is extremely annoying to the surgeon, and the cause of great delay and bother. It passes off after a period

of twenty minutes or a half hour; and you frequently hear it said in these cases, that just as the surgeon is putting in his last stitch, the patient, for the first time is becoming perfectly quiet, and in a proper state for an operation. I do not know any way in which this can be either anticipated or prevented. It has to be endured. You take away the ether and the patient keeps on, generally; you push it and the same is true. It is well to give the ether lightly, and to expect in fifteen or twenty minutes that the patient will get into a proper state of insensibility.

I think we do not realize how soon patients lose consciousness under an anæsthetic. If you ask them after the operation is over, and they have recovered their senses, on the next day, the last thing they remembered, they will usually mention some little incident, or word that was spoken at a time long before you thought they were fit to have an operation done; and yet mental consciousness of what was going on around them was entirely lost.

Now we ought to devote a few minutes to speaking of the recovery from ether, because that is quite an important point. The patient comes out of ether by an exactly reverse process to that in which he went in, — breathes less deeply, ceases snoring, perspiration becomes dried up; the pulse improves and grows slower; he gets a little color; finally recovers consciousness enough to open the eyes and talk; then passes into the state of intoxication, hysterical intoxication, precisely the complement of that which he had when he first got under the ether, before he fell soundly asleep; talkative and boisterous; demonstrative; he remains some time in that condition, and finally gets tired out, and then drops off into a natural sleep, which frequently lasts several hours, and need not occasion the slightest alarm provided

the breathing is regular and the pulse good. Of course, after any severe operation, during this period the patient should be carefully watched, because at the period when reaction comes on, and he wakes up and his circulation is restored, he is especially liable to have what is called intermediate hæmorrhage come on from small vessels, which had ceased to bleed in the faint condition of a prolonged etherization, but which will open and start up again when the heart resumes its power; but apart from that, and with general watching, one can feel perfectly easy about a patient who has waked up from ether, gone through the period of intoxication, and gone to sleep, for when he wakes the next time he will be rational.

There are several cautions to be used in giving ether to patients, with regard to their mental condition. One is with regard to giving ether to females; it is safer and more prudent that it should be given in the presence of some other female, as a nurse or friend, and that under no circumstances, unless those of absolute necessity, should the physician etherize a female patient alone. Various visions and dreams and unpleasant suggestions may occur to the mind of the patient in the narcotic state, and she may refer them to the person who happens to be giving the ether; and most unpleasant consequences have resulted sometimes from the assertions of the patient, the next day, of occurrences that never took place, or things that were never said. The presence of impartial witnesses, and especially one of the patient's own sex, is the best protection against the chances of such an occurrence. We must be extremely cautious when the patient is waking up not to say anything in their hearing which they may repeat to our detriment, especially points of prognosis. It is not always best that patients

should know that a cancer has been removed. Their lives are made miserable. If they hear that word, they feel that it is a sentence of death, sooner or later; and it is wiser sometimes that they should be deceived, and their lives made more comfortable. Anything that is said during the anæsthetic state may be heard by the patient and repeated to you, very much to your astonishment, the next day. This is true of going under ether, and coming out, both. You should keep silence, and caution those around to do the same. The attendants and every one should observe a religious silence with regard to any statements that the patient happens to make while intoxicated. Family secrets and all sorts of things may be told under circumstances which might make infinite mischief if they were repeated. It is one of the first lessons, I think, which should be impressed on the medical student, nurse and attendant on the sick, that nothing heard in the sick-room should ever go out of it. It is fully as much for your own advantage, in after years, as for the good of the patient.

Etherizing Babies and Children. — It is best, I think, in very young children to use an open sponge without any towel; give them all the air you can. It is of no sort of use to temporize with children when they resist; it is only cruelty. Seize them, put them on the back, hold the sponge to the nose, and put them to sleep. If you yield to their entreaties, which are very pitiful, you are really more cruel than if you persevere. In the grown person it is far different. He is in possession of reason, and if he feels suffocated it is much wiser to take the ether away an instant. But so sure as you give the child another whiff of air and take off the sponge, so sure you have got to begin over again the whole process of etherization. I would not be understood to

say it is not proper to take away the sponge occasionally in little children, but never in consequence of their entreating or asking; otherwise you frighten them more, hurt them more, and prolong the case. Babies and children are very quickly etherized, a matter of only a few seconds; and they speedily come out of it after the ether is taken away. I have seen in feeble children, once or twice, where ether was pushed very hard, convulsions produced. This is a very unpleasant complication, which indicates that you must take away and keep away the anæsthetic. I never heard of any dangerous consequences resulting; but unilateral epileptiform convulsions do occasionally occur in little children in the process of etherization.

Nausea and Sickness after Breathing Ether. — There again chloroform is better than ether. Patients who take chloroform are not so nauseated as those who take ether. The majority of patients who take ether have sick-stomach after it; and in some ways it is salutary. They recover from the ether quicker, get it out of the blood quicker, do fully as well to have a sharp period of vomiting after coming out of the ether. But we can conceive that there are conditions in which vomiting after ether may be very disastrous to certain kinds of wounds and certain conditions; for instance, in the peritoneal cavity after laparotomies; and it would be very desirable if we could find some agent that would check this nausea. Unfortunately we do not know of any. Bromide of potash, at one time, had an immense reputation in this respect, but proved to be fallacious and not lasting, as a remedy. An empty stomach, the giving of cracked ice, of aromatic spirits of ammonia, of minute quantities of brandy and water, sometimes of black coffee, sometimes of tea, will settle the stomach after ether. Sometimes

one agent does, sometimes another. If the vomiting after ether is a matter of an hour or two, it is generally of no consequence. In the condition of profound shock which comes on after severe operations and after very prolonged etherizations sometimes vomiting merely marks the continuance of the shock; and occasionally these patients go on with nausea persisting until the next day, and that is usually a very fatal sign.

III.

DELIRIUM TREMENS.

It would seem at first as though there should be some excuse for including this in the surgical course. The excuse in my mind is that we all have so much to do with it in surgical cases, and that it is especially in surgical cases that it complicates the treatment, and leads to so many bad results.

By delirium tremens we mean a peculiar condition of the nervous system produced by the use of alcohol, and, perhaps, by its too sudden abandonment. I would not, however, confine the evils of the effects of alcohol in surgical cases merely to this disease. You all, I think, must notice as you go on through hospital practice and sights that the patients who do not drink do a great deal better than those who do, in every form of accident and injury. The calmness of body and mind is with the temperate. The resistance to shock is with the temperate. The ability to respond to stimulants promptly is with the temperate, for the intemperate have already used up their powers of vital resistance; they have become accustomed to the over-use of stimulants, and they do not respond readily to them, and you do not get the benefit from stimulants which you expect. An illustration of this is seen in etherization; as we said before, it takes a great quantity of ether, and laborious and excitable and protracted etherization, to overcome the drunkard and make him go to sleep; whereas the patient who is temperate, as a

rule, takes it calmly, succumbs to it easily and recovers promptly. There can be no doubt, I think, that the continuous use of alcohol has a deleterious effect on the tissues, hardens them, thickens them, prevents absorption as readily, dilates the veins, leads to a slow and labored circulation; in that way delays absorption, and, moreover, produces finally some changes in the brain, which in the end are structural. All these things count against the patient when he is suddenly brought to meet the strain of a severe accident, or a severe operation.

Delirium tremens, applied as a name to a disease, indicates of course two marked conditions which are the characteristics of it; one is the temporary insanity, and the other is tremor. I should add to these, I think, a third characteristic, which is more marked in this affection than in any other single disease, and that is sleeplessness or vigilance. It is true that we see this more or less in other affections; but we always see it in the patient who has delirium tremens. A delirium, then, accompanied with tremor and with sleeplessness, expresses pretty nearly the description of a case of this kind.

There seem to be two varieties of it quite different from each other. One is the case in which the patient is very full of alcohol, and has not eliminated it from the system; and the other is the case in which he has been accustomed to the stimulation of alcohol for a long while, and has it suddenly withheld from him and misses its support. Perhaps we had better call the cases in the first class cases of pure alcoholism. In this class the patient is loaded with the results of the excretory products of alcohol which are not eliminated. His secretions are checked; his head is confused; his pulse is rapid; his skin is red and hot; his eyes are usually inflamed; his mind is irritable, somewhat delirious. He also

is sleepless, maniacal. He easily passes to another state wherein alcoholism terminates in positive convulsions; and they are a well-known occurrence — not very frequent, but yet they do occur; are distinctly epileptiform in character and quite severe. On the other hand, the patient who is suffering from the want of alcohol, from true delirium tremens, is pale and subdued; has a weak, soft pulse, and a creamy, moist tongue. He is delirious; but he is very quiet and civil, as a rule. His delirium is entirely that of fear; and all the efforts which he may make, which may result in injuring himself or in injuring others, are not apparently from any spirit of ugliness or homicidal mania, but to escape from the imaginary peril which he sees about him and wishes to avoid. The patient with true alcoholism gets over that condition in twelve hours, perhaps, and then passes on to the second stage of delirium tremens. On the other hand, very many patients are brought into the hospital perfectly sober. It is difficult perhaps to extract from them the admission at first that they drink at all. They show for the first day perhaps no change from other patients; but soon after confinement in bed with a fracture, or with a painful broken rib, or with a wound — soon after confinement, within a few hours or a day — they begin to show the restlessness, the sleeplessness and the tremor of true delirium tremens. These two classes of cases then would seem to be quite distinct; and although the final treatment of the two is practically the same, yet the alcoholism requires a different treatment while it lasts during its brief period, from that of the patient who begins with a delirium tremens without any alcohol in the system. In the patient with delirium tremens the tremor is most marked usually in the tongue and hands. He rarely can hold the hands steady, almost never can protrude the

tongue without constant tremor; and this is quite characteristic of this nervous affection.

This is not to be confounded with the patient who has a tremor from debility in advanced fever. Take, for instance, the typhoidal state, in which we have jactitation, subsultus of the tendons, shaking of the fingers, quivering of the muscles of the face, and the dry parched tongue and lips which the patient cannot control. In this typhoidal condition, perhaps the patient is unable to protrude the tongue even though he tries to do so in answer to your request. On the other hand, the peculiarity of the patient with delirium tremens is that he is excessively anxious to do whatever he is asked to do by the doctor, with the idea that it will be a benefit to him; and being already in a state of fear, he is extremely submissive and overdoes everything that you ask him to do. If you ask him if he can sit up, he bounds up in bed. If you ask him to put out his tongue, he puts it out with great violence, and holds it out a long while. While he is thus afraid that he is going to die, his mind is in such a changeable state that no impression lasts longer than a few seconds; and even though you may congratulate yourself that you have made some impression upon him, you cannot have the slightest confidence that it will last with him after you have left him. In this condition of pure delirium tremens his fears are so great that he forgets pain, and will abuse a broken limb, or a wounded surface in a way that no patient could bear in any other nervous condition. It is repeatedly the case that patients with delirium tremens, who are not properly watched, will tear off the splints and get out of bed, tear off dressings, etc. They are totally insensible, apparently, to the feeling of pain, while the stronger impression is on them of some reason why they should escape.

The reason why they wish to escape is because they see around them in imagination various distressing visions which frighten them to a terrible degree. All sorts of phantasms and illusions pursue them, and some of their delirious fancies are extremely absurd, of course. In this condition of mind they can hardly be held to be acountable for what they do; and they are really temporarily insane, and may commit crime without any desire to commit crime, but only to escape from imaginary dangers. The patient with delirium tremens, for example, will get out of bed and try to escape from the room or the ward of a hospital, and, if opposed, will not hesitate to inflict homicidal violence on the person who meets him if he has the strength to do it. In that way, you see, occasionally murder and crimes are committed in the delirium-tremens condition; and it must be strictly borne in mind that these people are in a state of absolute mania, and not safe to be trusted for a moment. Their promises are worth nothing. They are extremely dangerous to handle without assistance.

If an accident of any kind happens to a person who is habitually taking alcohol, which suspends suddenly the ability to take it, as, for example, an accident which causes them to have nausea, then delirium tremens frequently supervenes. It is not necessary that there should be a surgical accident either; for it is a well-known fact that delirium tremens is extremely common on the immigrant ships a day or two after they leave port, in consequence of seasickness interrupting the ability of the drunkards to take their customary stimulants. It is extremely common; and occasionally such patients have to be confined; and occasionally they commit suicide by jumping overboard. So that anything that suddenly shakes the nerves and inter-

rupts the action of the stomach brings on this condition.

It is a very curious fact that in some drinkers the delirium-tremens condition does not come on suddenly, but waits till a day or so after the occurrence of the accident before it begins to show itself.

Pathology. — The pathology of this affection is almost nothing. It is apparently a functional disease, and it does not terminate fatally very often. When it does terminate fatally, it is usually accompanied by great serosity of the brain, what is called in some books œdema of the brain; in the older books it was called by the older writers by the very impressive term of a wet brain. In this condition the autopsy shows the sinuses loaded with venous blood, the ventricles and the spaces about the arachnoid cavity loaded with serum, which extends down into the spinal canal. The mode of death is by gradual coma coming on exactly like what is called sometimes a serous apoplexy; coming on gradually, sleep deepening into stupor, inability to be roused, and finally resulting in death. Other changes may be found in the organs due to the habitual use of alcohol, but other changes coming from delirium tremens do not seem to exist; so that practically it is a functional rather than a structural affection; an affection of worn-out and exhausted nervous energy; and the pathology points to the treatment, which should always be of a soothing, supporting and quieting nature.

Now, obviously, it will not do at all to consider the patient with alcoholism in the same category, as regards immediate treatment, as the patient with delirium tremens. The patient with alcoholism is already loaded with the effete results of this indulgence; and the sooner it can be elimi-

nated from his system the better for him. With such a patient, then, sometimes an emetic is of use; always a mercurial cathartic is of use; and sometimes something to promote the secretion of the kidneys, or of the skin. After the alimentary canal and other emunctories have been thoroughly cleared out, then is the time to begin to apply the treatment we should give to real delirium tremens.

The only cure for this affection of exhausted nerves is sleep. This is a panacea in this affection. It is a cure, if it is long enough and if it continues uninterruptedly. To procure sleep has always been one of the great indications in the treatment of this affection, and the one thing most difficult to obtain. In almost all other affections we have in opium a most powerful remedy to procure sleep. Unfortunately there are two reasons why it is not advisable to use opium in delirium tremens; one is that it is totally inoperative unless enormous amounts are given. The ordinary dose only excites the patient. Where a grain of opium would do in one case, a good many grains are necessary to to subdue the mania of the patient in delirium tremens. In addition to this, it seems to exert an unfortunate effect upon the brain; and it has been pretty well proved by investigations that narcotism produced successfully with opium has some dangers in delirium tremens; that it is liable to result in lasting coma, and to carry the patient off into that serous condition of the brain which terminates finally in death. Chloral also is objectionable to a certain degree on account of its depressing effects. We know that chloral is quite a powerful hypnotic. We also know that it has a marked effect in depressing the action of the heart, and that it is rather accumulative in its action; and if several successive doses are given the combined effect may last longer and be

greater than we had expected. As a depressant to the nervous system and the heart it is somewhat dangerous; not that it should be set aside, but be used with great caution. One might think that ether would offer the best possible remedy we could use in delirium tremens. The patient, however, succumbs to ether with difficulty, but finally goes to sleep. His muscles are relaxed; he bursts into a drenching sweat, and sleeps for a while with good effect; but so far as I have observed he always wakes with the delirium unabated; and it can be used with success, apparently, only as a temporary expedient. As a temporary expedient it is extremely valuable. In the patient with delirium tremens who is strong and violent, and suddenly meets with a severe accident, has a bad fracture, for instance, and has got to be transported, it may happen that etherization will be the best way to do it. He may be etherized fifteen to thirty minutes until he can be transported, perhaps put to bed, perhaps have his fracture treated, his limb dressed; but as a direct remedy, a curative agent, ether does not seem to have had a marked success. Chloroform, I should suppose, would quiet the patient quickly, but be a good deal more dangerous in this condition than in the ordinary condition, and be liable in some unexpected cases to kill the patient.

In order to procure sleep, as far as drugs are concerned, we have to resort to the milder class; and often they are quite as effectual as the stronger. The most efficient, and the most innocent of all that are efficient, is the bromide of potash. That may be given safely in large doses, at intervals of four to six hours, for quite a while; and although if given a long while it finally affects the brain, reducing its circulation so far that the patient becomes temporarily demented, as I have seen in a number of cases, yet for the few

days that perhaps we have to use it for delirium tremens, it almost never does any harm. It frequently is successful in procuring sleep; and it is apparently an innocent agent. Now much milder agents are sometimes successful, as, for instance, the tincture of hops (which is a good bitter), or valerian, or the preparations made from valerian, especially the combination of valerian and ammonia known as valerianate of ammonia, which is a good stimulant and good quieting agent, and apparently perfectly harmless.

Certain agents that have a stimulating quality are also sometimes very useful, especially the compound spirits of ether, called otherwise Hoffman's anodyne; this used to be called the heavy oil of wine, is a stimulant and also a sedative agent. It is a good agent to use in delirium tremens. Probably paraldehyde would come in the same class, to a certain degree. Sulphonal is uncertain, extremely slow. Its therapeutic effects do not come on apparently for several hours after administration, and then last a good while. It is to a certain degree a depressant to the heart; and it is to be classed, I should think, in the treatment of this disease, somewhat in the same category as chloral.

Stronger agents were sometimes used with great success, but they became so dangerous that I think they have been pretty much abandoned. I would instance, as an example, digitalis. This used to be very largely given, twenty years ago, in delirium tremens; and the doses were enormous, sometimes one drachm of the tincture, sometimes that amount in two successive doses. This frequently quieted down the circulation to such a degree that the patient went to sleep; but sometimes fatal cases arose from its use, and it was then abandoned for safer agents.

There are some things which sometimes will put the pa-

tient to sleep merely by quieting the nervous disturbance which arises from the condition of the stomach. Of these capsicum is extremely valuable. It is appalling to see the ease and satisfaction with which the drunkard will take a large bolus of red pepper. He sometimes takes ten grains of this. It is easily administered in a crumb of bread. That sometimes quiets all the aching and distress at the epigastrium, and in that way tends to take the place of alcohol, and so secondarily to induce quiet and sleep.

Should alcohol ever be given? That is rather an important point. Many authorities think it should; some think it should not. I must say, for my own part, that I think a limited amount of alcohol, in the form of malt liquors, is useful and justifiable in treating these cases. You must bear in mind when you get one of these bad cases that in almost every case the patient has been a spirit drinker, accustomed to liquors which contain from forty per cent. to fifty per cent. of alcohol; and he is accustomed to carry large amounts. The percentage of alcohol in malt liquors is so small that he may drink a large quantity of them without approaching the intoxicating dose to which he was accustomed; and a pint or quart of ale is nothing, almost, to the habitual drunkard. The advantage of giving a certain amount of stimulant in this form is that it contains the bitter and narcotic effect of hops, which is very grateful to the stomach, and the nutritive effect of the malt; that is, it combines a tonic with a certain amount of nutrition and a moderate amount of alcohol. Many cases of delirium tremens do extremely well on being allowed a moderate amount of strong beer or ale; and they get along without much other drugging.

I know that in these cases the care of the patient is so

wearing, and the anxiety, when the case is prolonged to the second or third night without sleep, is so great, that one is tempted to try other forms of drugs, and to administer them to the patient in large quantities to induce sleep. I do not think it is good practice. I think it defeats its end, and sometimes leads to bad results. I should rather pin my faith on mild drugs, and trust to food and gentle stimulation in the treatment of this affection.

This leads to another point: How much is it best, and in what way is it best, to restrain the patient? To tie him down and put him in the strait-jacket, or to fasten the ankles and wrists and put a sheet across the chest, as you sometimes see, is not in itself beneficial. I believe it is directly injurious; and if it can be dispensed with, it had better be. You can imagine for instance, the patient, almost terrified to death by the visions that he sees around him, tied down. He struggles frantically, exhausts himself, throws himself into a state of great prostration, becomes more and more alarmed. He cannot sleep, certainly, in that condition, and he probably receives more injury than benefit from it. At the same time, of course, in large institutions where a good many of these cases have to be taken care of, it is absolutely indispensable sometimes that some mode of confinement should be used; only I would enter a protest against its being used indiscriminately, or any more than is absolutely necessary. Take the case in which we can have our own way, in which the patient can be kept in a private room, or house, by himself, and have plenty of attendants; then it is never necessary to tie the patient, because the best form of physical restraint is by the nurses holding him temporarily and then relaxing, amusing him, talking with him, trying to win his confidence. In that way he does not

exhaust himself, is not so alarmed, and gets well a great deal quicker.

Another point which I think is very important is, that these patients should not be left alone, and should not be shut up in the dark. Nothing terrifies them so much. They are very fond of society while in this state of mind. They seek intercourse with everybody about them. They are the better for it. Of course, if at any time they show the slightest disposition to go to sleep, then is the time to quiet things down, exclude the light, and while carefully watched, allow them to sleep as long as they will, not being afraid that they will sleep too long, as a rule. The presence of people with them, cheerful conversation, amusing them to a slight degree, letting them feel they are not deserted, assuring them they will get well, is of great importance in this nervous condition.

Now the next most important point, perhaps the most important of all, is food, nutrition. If they can take nutriment, if the stomach will tolerate food, they almost always get well, and they almost always go to sleep after they have taken food. The trouble is, in the early stages, that the stomach is often extremely irritable and food is not retained. It is in this condition, I think, that minute doses of calomel are sometimes extremely useful, and also the use of carbonic acid gas in all forms of effervescing waters. Ice may be freely given and minute doses of calomel; and then gradually the patient can be tried with lime-water and milk, or some concentrated liquid food, etc. If the stomach will retain food, the patient should be fed on liquids at short intervals, precisely as we should treat a very sick patient in an exhausting disease. It is a condition of exhaustion, wants food, plenty of it, administered often in small quanti-

ties and in the liquid form. If you can once get the stomach to tolerate food, and afterwards give the patient something like a little malt liquor, frequently you can get along without any drug of a narcotic kind; and if that can be done, it is of great advantage.

I said that sleep was the panacea. It is in the majority of cases if it is lasting enough. Unfortunately, there is a certain percentage of cases where the sleep is not satisfactory. In the typical case the patient wears himself out in from twenty-four to thirty-six hours, and finally drops to sleep, and is thoroughly and dead asleep, and sleeps eight, twelve or fourteen hours, something of that kind, and wakes somewhat exhausted, but perfectly calm and conscious; then the disease does not come back. The thing is over, and he needs only careful nursing and feeding to get along. On the other hand, in the exceptional class of cases, the patient sleeps a shorter interval, and wakes delirious; and those cases are always of extremely bad prognosis. They terminate in two ways: either these short naps are ineffectual, and with recurring delirium, until finally the patient becomes exhausted, and passes into the condition of serous effusion of the head, and dies; or else, in another class of cases, and a pretty large one, the delirium keeps recurring, and he passes on to permanent insanity. I do not think it is perhaps realized how often we see cases at the hospital which after a week of struggling of this kind cease their tremor, perhaps cease a good deal the morbid vigilance, but remain permanently in a state of mania, and are practically insane. Eventually, perhaps, they have to be removed to insane asylums, and pass through some of the stages and treatment of ordinary mania, with various results. This would seem especially to be the case with powerful men of

athletic habit, accustomed to live out of doors and commit great excesses; at any rate, that is the class of cases I have in mind.

Sleep, when it comes and lasts, and the patient wakes sane and clear, is a cure. When it comes interruptedly, and the patient wakes delirious, the prognosis is extremely unfavorable.

You must see, of course, that with a patient in this condition, it is extremely difficult to treat a fracture, or to bring about a successful result in a head injury. It is in injuries of the extremities and in injuries of the head that delirium tremens is so disastrous, either in producing bad results to the injuries themselves, or in finally killing the patient. Delirium tremens, as you may imagine, is the worst possible complication of a scalp wound, whether with or without a fracture of the skull. The patient's brain is in a morbid state of excitement for a good many consecutive hours. He is liable, of course, to set up a meningitis in consequence of his injuries; and his chances of doing this are very much increased by the delirium tremens which accompanies many of these cases. In injuries of the extremities, especially of the lower extremities, it is almost impossible, in fractures, to keep the parts still while the patient is in a state of delirium tremens. I have sometimes found that they did best by being slung up temporarily in the Nathan Smith anterior splint, in which the leg is suspended on a wire frame, and held up over a pulley, so that it hangs. In this way a fracture of the tibia or femur can be held relatively quiet, and the patient can move about all he likes without doing much injury to the leg, because the leg is kicking about in the air, and not reaching any other object. With this apparatus, the patient can get out of bed,

sit on a chair, and get into bed without disturbing the fracture.

What could be better than instantly securing the patient, and doing the leg up in an immovable plaster cast? Any amount of apparatus that we can safely put on to the living tissues of the limb will not be sufficient to control the quivering and twitching of the long muscles which the patient can keep up inside of the cast, so that it sometimes happens that upon removing the cast after a week or so, we find a compound fracture where originally there was a simple one. It is perhaps safer that the limb be put up in the Nathan Smith splint, and the patient watched a day or two until the delirium has subsided; or if the plaster cast is used, it is safer that it should be in the form of a high trough, having the small surface of the front of the bones exposed, and thus the condition of the fracture can be constantly seen and watched. It may seem almost incredible, but I have known of instances in which the patient removed the plaster cast from the leg when not thoroughly watched. To be sure he had very little of his finger-nails left in the morning. Also, more remarkable, this patient finally got a good leg, although he had a fracture in the middle of the femur, and we expected almost anything to result from the way in which he tossed about for a number of days.

Other agents produce a certain sort of delirium tremens; for instance, tobacco, if used in very great excess; tea notably. The excessive tea-drinker has a tremor and a great nervous excitation or wakefulness; does not have the delirium, but the other phenomena of delirium tremens, and he has to be treated in the same way.

The treatment of the convulsions which we occasionally see in the drunkard is pretty difficult. I do not know that

we can do much except to try as rapidly as possible to get the alcohol out of the system. These convulsions are occasionally fatal. I have seen several result fatally after a day or so of continually recurring convulsions following the condition of pure alcoholism. The treatment, of course, should be to eliminate the alcohol, and to soothe the patient if we can.

Three or four other agents I will speak of for a moment, which are extremely useful with the drunkard in averting an attack. For instance, a person comes to you, and says plainly: "I have had these attacks before, and I feel one coming on. I am getting shaky, cannot sleep, am beginning to think I see visions, etc., etc." What shall be done? Of course, he wishes, and you wish, that he should abandon the habit of taking alcohol, and you want to carry him through this threatening attack, and compose his nerves. In that case there are some other agents that seem to do a great deal of good. Most important of these, I think, are the preparations of coca, given in small doses, especially the coca wine, which is extremely useful in counteracting the excitability produced by this state of slight delirium tremens. Camphor also is another old-fashioned remedy, sometimes very grateful to the patient, and very soothing. Asafœtida, a much-disused agent, but still, I think, an extremely valuable one, may be given in pills well coated over so that it is tasteless and does not nauseate the patient. It should be given largely to be of any effect — ten, twenty to thirty grains; and its advantage is that it is quieting, disposes to sleep. It is also to a very marked degree stimulating, and it is also somewhat relaxing to the bowels. These three qualities render it extremely valuable in slight nervous affections resulting from incipient delirium tremens or alco-

holism. Hyoscyamus also seems to have a very good effect sometimes in quieting the patient and making up for the loss of sleep and the nervousness that he feels. These patients also may sometimes be given coffee and tea, if they wish it, to take the place of other stimulants. Once in a while some effect may be got from counter-irritation applied over the pit of the stomach, which sometimes affords great relief in this nervous state.

We would say then, in short, to sum the matter up, that if you have a patient who is in this incipient stage, you try these simple remedies and take care of him. If you have a patient who has been on a tremendous debauch, and is still full of alcohol, the treatment of delirium tremens will not be of the slightest avail until you have eliminated the alcohol from the system, and that can be done most speedily by simple cathartics, by producing sweating, stimulating the kidneys, and allowing a little time to elapse before you apply the other treatment. When you meet the real case of delirium tremens, it is best conquered by gentle and sustaining treatment rather than by any violent treatment; personal restraint instead of mechanical restraint; plenty of food if it can be taken; if liquor is given, in the form of malt liquor; if narcotics are used, the mildest possible agents to be tried first. If the patient sleeps, and has a good sleep and wakes once sane, he is certainly cured. If he has an imperfect sleep and wakes delirious, he may get another and better one, and wake up sane; but he is extremely liable to get a succession of short naps, and wake with a delirium that is liable to terminate in acute mania.

It is a little difficult, until you have seen a good many of these cases, to recognize this condition of delirium tremens when it is first coming on. Its incipient stages, however,

are quite marked to one who has seen them. These patients usually begin by being very talkative and extremely communicative with regard to their past history and the nature of the accident. They seek conversation with every one about them. They are a little too wakeful and excitable. They have rather a too wide-awake look about the face. They are too alert all the time. Accompanying this there is very frequently a little tremor to be detected, until at last delirium tremens is developed with great rapidity and positiveness, and there can be no doubt about the case. Of course, if these early stages are detected and treated, we have a much better chance of warding off the subsequent affection, so to speak, than if they were overlooked; hence I think it is a good practice in treating all hospital cases, where we have to deal with such an immense amount of these results of drunkeness, to always consider that point when you look at a patient brought in with a broken leg, for instance. He has got a broken leg; what else? Is he a drunkard, or not? It is of no use to ask him. You must judge by looking at him; and in many cases you can learn to distinguish the person who drinks from the one who does not drink. If you are in doubt, you had better give him the benefit of the doubt, and watch him closely. Administer some gentle solution — a mercurial cathartic; perhaps early in the case, a mild stimulant, or tonic compound like beer; or the early administration of a sedative of simple nature the first night you see him. In this way you may sometimes avert or postpone, I believe, the severe cases, and lead them to better results.

The law holds the drunkard accountable for anything he does. It is a little in dispute, I think. A good deal is to be said on both sides; and I think a good deal is said on both

sides by judges in court as to how far the patient actually crazy with delirium tremens should be considered an accountable being. We know how far the point is stretched in endeavoring to secure the acquittal of criminals, that they may have inherited insanity, or been insane, or had a temporary insane impulse, or something of that kind, and that sometimes this point is carried so far as to be abused. If any person is to be allowed any privilege or loophole to escape from the consequences of crime, it seems to me it should be allowed also to the case of delirium tremens. It would not do to excuse the man who is clearly drunk from the consequences of the crime he may have committed, because he voluntarily put himself in the condition; but if he has passed into the state of delirium tremens, and then committed a homicide, not from malice aforethought, but only because he was afraid something was about to happen to him, I think he ought to have the benefit of the doubt, as being temporarily under the dominion of an insane impulse. I would strongly impress upon your minds that you cannot trust in the slightest degree patients with delirium tremens. You cannot believe them to the slightest degree, and you should have them closely watched. By way of illustration I may cite one case which occurred in the City Hospital, in Ward K, which is on the ground-floor, and which at that time did not have any netting or bar at the windows, and which happened to be used at that time for females. Going through, one morning, I found an old drunken woman, well advanced in delirium tremens, who attempted to cut her throat. She did not succeed. She only made a gash through the flesh, which had been sewed up, and that was doing perfectly well. The nurse said to me: "I wish you would control her, because she keeps pulling off the bandage, and

I am afraid it will start the bleeding, etc." So I made some remarks to her, which I thought produced a very fine effect. I asked, "Do you want to get well?" "Oh, yes," she answered. "Well, if you want to get well, you must not touch these bandages. You will die if you touch them." "I will never touch them." She sank back quietly, and I walked down the corridor. Hearing a commotion, I looked around, and to my astonishment this patient had got out of bed, pulled off the bandages, and jumped out of the window. You may produce an impression one second; it is forgotten the next second; and a crime or suicide may be committed the moment your back is turned.

IV.

GUNSHOT WOUNDS.

THE lecture of the afternoon is on gunshot wounds. The reason for speaking of them is that, although we are not in a time of war, yet they are very common in civil life. Many of them occur as the result of accident; and the majority of them occur from pistols, simply because the pistol is the weapon that is most frequently carried, and it is often carried concealed. On account of the wounds being almost all pistol wounds, the balls are small, — 32 to 38 calibre; and the large Minié rifle ball we should not meet with in civil life, as a rule.

The Literature of the Subject. — In speaking of this subject, the first thing is to say a word with regard to its literature, for it has a literature of its own; and some of the older authors are extremely valuable. Hennen's "Military Surgery" was written in the eighteenth century. That was the first. Then the one who did the most, I think, to give to military surgery strong views of common-sense, the man who first advocated and gave the reason why in the gunshot wound of a large artery we ought to tie both ends instead of being contented with securing the bleeding end alone, was a Scotchman by the name of Guthrie. He followed Wellington; and his book was written on the campaign called the Peninsular War. John Hunter also wrote on gunshot wounds and with great success, as he did everything. The man with the largest experience in the world was Napoleon

the First's surgeon, Larrey. He went through all his wars, thirteen or fourteen wars and innumerable battles; and was his surgeon-in-chief during all that time. He wrote a good deal, and saw an immense deal, of course. Then we come to the Crimean War. There was at that time a good book produced by Mr. Longmore, which is classical on gunshot wounds. Then the Schleswig-Holstein War was the time that Esmarch wrote his remarkable treatise on the treatment of gunshot wounds. Then we come to the time of our own Civil War; and the results of the collection of the literature of the war are greater than exist in the annals of any other country; and the "Surgical History of the War of the Rebellion," edited first by Otis, and afterwards by other surgeons in Washington, is unsurpassed in its mass of statistics; in the rarity of its cases among such a mass of statistics; in the mode of illustration by photographs and wood-cuts; and it is also further illustrated by references to the Army Medical Museum, where many cases can be verified by pathological specimens. That is the greatest treasure-house of knowledge on gunshot wounds which exists. Later we come to the Franco-German War. We have Billroth and numerous other Germans, and several Frenchmen. Many of them have written good treatises.

I should say that during the very latest wars more advances have been made in hygiene than in the absolute treatment of wounds themselves. If you go back to old times and compare the treatment with that of modern times, you will find two great differences. The most conspicuous is due to the introduction of antisepsis; but quite as marked a difference between the results of wars of this century and the last is due to the character of the weapons and the missile. In old times we had the smooth-bore musket and

the round ball; in modern times the rifle and the Minié ball. The old musket inflicted a very different wound from the modern conical ball. The old round ball merely perforated the tissues and the bones, and did nothing but injure the parts it struck; in other words, it drilled a hole clean through the bone, not splitting it longitudinally at all. On the other hand, the great momentum and velocity and spiral movement of the conical ball splits a bone all to pieces. It will go through, but rips in all directions. This is not due to the false idea which used to be entertained, that when serious and terrible injuries were found upon the wounded, the enemy had been using explosive bullets. They are not often used. Their results must be peculiar if used — more like bomb-shells. The character of the missile, then, has made an immense difference. The latest missile of 1896-97 perforates clean, and rarely lodges.

Now what is a gunshot wound, and how does it differ from the ordinary incised wound? It is lacerated and contused, and to a certain extent burned; that is to say, the bullet is thrown with such velocity that it strikes the body almost, you might say, in a semi-molten state; changes its shape on the slightest impact; turns about and twists about certain tissues, and takes a tortuous and uncertain course — lacerated and bruised and slightly burned.

The difference in a gunshot wound from the ordinary flesh wound, or compound fracture wound, is that it is almost sure to suppurate; and Larrey, in his book, refers to one case that he saw where a man was shot through and through some fleshy part of the body, and to his great surprise that wound happened to heal by first intention. On the contrary, the ordinary gunshot wound has got to discharge necrosed tissues and sloughs; and it takes several weeks to do it; so that the

simplest flesh wound inflicted by a ball takes from two to six weeks to heal even under the best treatment. I allude to perforating wounds where the ball has gone through and through the skin. If the ball has entered and lodged, then the prognosis is much longer, and sometimes more severe. Modern antisepsis, however, may avert suppuration, if the wound is clean.

The ball changes shape. It is a curious thing; it is almost unknown to take a ball out of the human body and find it in its original shape. It is usually flattened down into a mass of lead, somewhat like a hammered-out piece of lead, or like a piece of coin with rough edges. It is turned from its course by almost any object it meets; but it makes a great difference how fast it is going. If fired at short range, and having recently left the cartridge, it penetrates with great power; if at some distance, it is very easily turned from its course. The most curious instances of deflection have been known, especially with the old round ball, and Hennen and Guthrie give extreme instances; one, in particular, where a spent ball struck a man at the *pomun adami*, and went round the neck and came out without entering anywhere else. So, in estimating the course of the ball, besides the fact that any object it strikes may turn it aside, we have got to estimate two other factors: one is the position of the body, or the limb, at the time the wound was received; and the other is whether or not the part when struck happened to be in motion. Supposing a soldier was raising his arm to fire, three or four muscles in motion, the ball would strike and be twisted into an unusually tortuous course; not only by striking the parts which would turn it, but by the fact that muscles in motion would give a very different direction to it, a tortuous course; a lacerated, bruised, somewhat burned

wound; and an uncertain depth, according to the momentum of the ball.

Now a great deal used to be said, and great stress was laid, upon the different appearances of the wound of entrance and wound of exit of the ball. It was said that the wound of entrance was a small hole, with the edges inverted, and the wound of exit a larger hole, with the edges everted. That, however, was more true of the old round ball than of the modern missile, which tears a way in, tears a way out, splits tissues; and sometimes you are unable to tell one wound from the other, whether entrance or exit. We must not confound those very marked appearances with the minute wounds of little bullets that are fired from some of the smaller revolvers. The tissues close over at once. It looks as if a little semicircular flap had been cut, the ball slipped in under, and almost nothing to show except a line under the tissues.

We are all familiar with the fact that if a pistol or gun loaded merely with powder happens to be fired close to an exposed part of the body, that the powder lodges in the skin, and the skin is severely burned; and this is all due to the proximity of the weapon to the skin. In the same way the cartridge which carries the ball, if held close to the surface against which it is fired, either in homicide or suicide, will give the powder-burning and the staining of the skin up to a few inches distance, and not if the weapon is held farther off. This is important often in medico-legal investigations. We are all familiar, I think also, with the fact that a charge of shot acts very differently according to the distance from which it is fired. If fired close to, it makes a ball, as the French say; goes in in a body, and tears a wound through the tissues. It is not scattered, and goes

precisely like a large slug; but if fired from a distance, it scatters more and more, according to the distance from which it is fired, and often penetrates but very little way into the tissues.

Large missiles never lose their momentum until they stop; never lose their ability to injure the part which they happen to touch. Those missiles which are of large size, such for instance as the round shot, fired from a long distance, we will suppose, have nearly stopped; perhaps the ball is merely rolling, almost ready to stop. At that very time it is capable of inflicting a crushing injury upon any part with which it comes in contact. If a round ball comes along his course, the soldier who is waiting to go into the line of battle may be tempted to catch one and to stop it with his foot; and the result is a crushed ankle, although the ball stops a few feet farther on. These spent balls, if they happen to strike any person near the end of their course, roll over the surface, as over the abdomen, and will inflict the same internal injuries that the cart-wheel will in going over the abdomen. They will not break the skin, but may rupture internal viscera, as the liver; they will not break the skin of the foot, but will crush the bones precisely as the foot which is caught in a vise, or an elevator. In other words, a large spent ball, although near the end of its course, possesses the power to pulpify muscles and break internal viscera without really breaking through the skin. The ball goes pretty quick. Nobody sees it. One of these curious things happens to a person: he feels something go over him, looks and there is no wound. He feels sick and faint and begins to vomit. This led to the curious belief, which had strong credit among many people, of injuries inflicted by the *windage* of a ball; that a ball passing

within two or three inches of a person was as capable of inflicting fatal injuries as one which happened to strike him. This superstition was disproved by the experiments of a Frenchman, a few years ago. I will read a few words: "Monsieur ——, who recently made experiments to determine the influence a cannon-ball produces on the surrounding atmosphere in its rapid flight through it, had a machine constructed by means of which the force exerted by the wind of balls passing at various distances could be estimated. At three inches from it the ball produced not the slightest effect on the delicate instrument he had constructed. His conclusions are that projectiles passing close to the body exert no necessary influence on it; and that the wind of a ball is incapable of determining any lesion of the human body."

This was based on a careful set of experiments under government direction. On the contrary, those who fall mysteriously injured without a wound and without a ball to be found have been struck by a spent ball which has passed over them.

What is the future destiny of the ball, provided it does penetrate the human body? If inflicting a flesh wound and lying only in the flesh, it is harmless. At first it forms a suppurating tract which leads down to it. Out of the sinus are discharged sloughs and foreign substances. Eventually, if the tract refuses to close, it assumes the character of a mucous membrane, precisely like the sinus we see in fistula and various other sinuses connected with deep-seated abscesses. If, however, it does not take on this condition, if the tissues possess sufficient vigor to close the wound and leave the ball in, then the ball has developed around itself a sort of adventitious tissue made up from connective tissue,

which is called a cyst. At any rate, a smooth and painless little membrane surrounds the ball. It lies in this little pocket; and if it happens to be well placed among muscles which are not constantly being pressed and struck upon, it is carried for years, until the end of life, without doing the slightest harm. It does not inflict lead-poisoning, does not produce any other trouble, except that it is frequently the seat — all gunshot wounds are — of rheumatic pains as the patient grows older and is sensitive to changes of temperature. The destiny of the ball, if not extracted, is to become harmless and encysted, provided it is placed among the muscles. The only places in which it can do harm, and in which its extraction is imperative if it can be got at, are in the viscera, as the liver or spleen, or in the large cavities of the body, or in contact with bone — not only in a bone, but in contact with a bone. Here is a curious fact first pointed out by Hennen and Guthrie, and verified by subsequent writers, that no ball can lie in contact with a bone without keeping up a grating and rubbing which leads to caries and necrosis and permanent invalidism on the part of the patient. I quote the words of Mr. Guthrie: "As a rule, the ball should not be allowed to remain in contact with bone. If the ball lodges in the head of a bone, it gives rise to caries, amputation or death; if it is in the shaft of the bone, it gives rise to necrosis, with years of misery; on a flat bone, caries, sinuses, contraction of the limb, and a useless life."

I will cite a case of my own, which was a very marked one. In that case the patient had been shot five or six years before, shot in the mass of the glutæi muscles behind the trochanter; the ball was never extracted; the sinus never closed; the gluteal region had wasted as in hip-

disease. The pain and sciatic trouble was so great that it contracted the limb as in hip-disease, and the man walked with a crutch. There was a suppurating sinus in the gluteal region. Had it not been for his positive history of receiving a gunshot wound, he would have been considered an adult case of hip-disease, with abscess. After being etherized and the sinus explored, a ball was found and extracted, not in bone, but lying on the ilium; and it had eroded a little cavity on the ilium, in which it lay. The bone was carious and constantly discharging. It had not perforated; it had merely gone down and laid on the bone; and its contact there of six years had kept up abscess, suppuration, caries, whereas if it had stopped one-half inch farther out and rested in the glutæus muscle, it would have become encysted, and never given any trouble at all. That is quite a marked case of this peculiar state of things; so that if we have reason to believe the ball is in contact with a bone, we almost as much fear bad consequences as if we know it has penetrated the bone, and has lodged somewhere in the shaft or head of the bone. In the head of the bone it is almost inevitable that it has broken up and fractured the bone and will lead to destructive arthritis. In the shaft of the bone it not only perforates but splits the bone a long distance, makes the worst compound fracture, usually is followed by necrosis, and quite often requires amputation to save the patient's life.

What should be the treatment of an ordinary gunshot wound?

The first inquiry is to see if there are two holes. If there are two holes the ball is probably gone. In nine hundred and ninety-nine cases out of a thousand the ball has gone through if there are two holes. It is almost

against the possibility of the doctrine of chances that the patient should have been struck by two missiles making two wounds of entrance. Then it is a perforating wound. The ball has escaped. We have nothing to do but try to probe through the sinus and examine it. For what purpose? The cartridge does not follow the ball, but remains in the rifle. The ball has gone through clean and left only a track. Why should we insist upon probing and torturing the patient when there is every evidence that the ball has gone through? This opens up an important point in the treatment of gunshot wounds.

All substances carried in by the ball are infinitely more dangerous than the ball itself. A gunshot wound of the leg, for instance, cannot be inflicted without carrying a portion of the trousers or drawers into the wound. In other parts of the body it may carry into the wound all sorts of things, — a bit of leather or bit of metal, a portion of a button. Sometimes objects near the person are struck by the ball and carried through, as, for instance, a splinter from a small tree or shrub; various things of that kind are often carried into the wound. Remember, then, that threads and bits of cloth, etc., are infinitely more dangerous, when buried in the tissues, than a piece of lead.

An illustration of this we frequently see in modern times by the occurrence of tetanus after a very slight wound inflicted in the palm of the hand of children by what is called the toy pistol. This pistol has no ball, but has a cartridge filled with an explosive that makes a loud noise. The little boy almost always shoots himself in the palm of the hand at the root of the thumb. What goes in? The powder goes off. It is a piece of pasteboard, of which the little shell is made, that goes down under the palmar

fascia, and there rots. It is not detected; it cannot be felt. Perhaps the conscientious physician finds this little puncture, probes it, and contents himself with washing it out, but leaves the enemy under the fascia. This after a few days sets up a cellulitis of the gravest kind, which, together probably with the ingress of microscopic germs, inflicts such a shock upon the nervous system that the spasms of tetanus set in; and when they have once set in, as a rule, it is too late to cure the case. Then perhaps some one detects the cause of the trouble, opens the part, turns out the bit of pasteboard and washes out the wound. That is what ought to have been done in the first instance, and such treatment would have prevented the trouble. The sale of this toy pistol has been forbidden by law, and we now have very few of these wounds; but five or six years ago we had large numbers of them. The cases of tetanus following these were frightful, and the mortality frightful.

This illustrates, from a matter of every-day experience, precisely the dangers which exist in the ordinary gunshot wound, which is not probed and washed out and kept cleansed from the foreign bodies which are carried into it, and which are far more dangerous than the ball. The woollen threads from the trousers or from the coat, for instance, are carried far into the wound. Impregnated with dye, they rot easily, set up a cellulitis and deep suppuration. Hence the first treatment of a gunshot wound should be to see if there are two holes and the ball has got out. Then the track must be thoroughly probed, washed through and through, so as to be sure no foreign substance is there; and in case great obstacles are met with, it is better to enlarge a little the wound of entrance or exit, both through the fascia and the skin, so as

to be able to pass the finger through the tissues, in order to be sure that there is nothing there.

On the other hand, where we see an ordinary case of gunshot wound with but a single hole, we say the ball is there. There is the need of exploring that there was in the other case to extract the foreign bodies, and, if practicable, to extract the ball. If, for instance, the ball has entered the calf of the leg and gone in a straight course towards the tibia, we feel very solicitous lest it has perforated the tibia, or is lying in contact with the tibia, in either of which cases it will give rise to caries, necrosis, and crippling of the limb. The best thing, of course, with which to explore a gunshot wound is the finger, and it is far superior to all the probes that can be used. The little finger frequently can be got in where the larger ones cannot, and if it can be carried down to the depths of the wound, it gives more information than any probe. Now the probe is uncertain. It may be twisted into various shapes and inserted in all sorts of directions until we can determine perhaps the direction of the ball. Down at a certain depth the probe strikes something hard. What is it? We cannot tell whether a ball or bone, unless we can tell anatomically. It was to obviate this that Nélaton devised the porcelain probe, which was used with such success in the tarsus of Garibaldi. The latter was shot, and carried a wound in his tarsus which would not heal. Nobody could find the ball, and M. Nélaton was sent for. With his peculiar probe he found the ball, extracted it and Garibaldi got well. This was a very fine history for M. Nélaton and for science generally. He coated the point of the probe with porcelain, so that upon striking the ball a lead mark was made upon the probe, and nothing else would do this. That probe was formerly used a good deal, but I do not

think it is used as much as it was. There is a limited class of cases where the ball is far from the surface and in which it may give useful information; but the objection is that the end of the probe has got to be of considerable size. This will not go into a puncture; the size of the head will prevent it, so that sometimes it becomes perfectly useless, and the ordinary probe gives more information. Better than all is the finger, if it can be introduced by the process of *débridement*, or cutting the fascia in two or three directions, and passing the finger in to see what we can find, whether a foreign substance, or a ball. Billroth goes so far as to say that the ball that cannot be reached with the finger is not found and extracted by other instruments.

Electricians have devised several interesting means of making known the presence of a ball. One is by setting up a galvanic current which rings a bell at the hand of the operator when the ball is touched. This is of very limited application. It is a surgical toy, that is all. The finger is the thing, if it can be got in.

Supposing there is but one wound. The ball has pursued a tortuous course. We have traced it for two or three inches and cannot reach it. Is it worth while to mutilate the person further to seek for the ball? It is not; for in the largest percentage of cases the ball would do no possible harm and would become encysted in the tissues. This is the case in the muscles of the calf or in the thigh, or under the forearm where it runs up on the interosseus sheath, or between the flexor muscles. Of course, we should ask the position in which the person was when the wound was received; ask the direction from which the gun was probably fired, if it can be ascertained; then endeavor to put ourselves in the position of the gun and the limb in the position in which it

was, and follow that line, as far as possible, to discover the course of the ball. We should also, of course, in all cases where there is only one wound, examine carefully the limb in every direction about the opposite side, and on every side, to see if we can possibly detect anywhere a hard lump which may mean that the ball has perforated through and is lying under the skin, or in the cellular tissue. A good many balls are found from five days to a week after they were shot in, but not at first. The thing is overlooked; but presently there appears a black-and-blue spot where the ball was lodged. This attracts attention, and somebody says, a week after the accident, "There is a black-and-blue spot." That is the ball almost invariably; and it may be cut upon and found. It may not show itself at first by any ecchymosis.

Now there is one peculiar danger in gunshot wounds that I do not think exists to any such extent with any other class of surgical injuries, and that is the danger of secondary hæmorrhage. Let us see why this is. It arises from the fact that the ball boring about through the limb in various directions passes over and bruises the vessels. It need not perforate them, need not nick them. If it nicks them you have immediate hæmorrhage. Supposing it bruises a large vein or artery. Subsequently that wound will not heal without some degree of suppuration and discharge of sloughs. The vessel is beating incessantly in the depths of the wound. Its bruised wall ulcerates and gives way, and hæmorrhage takes place, which is called secondary, because it comes on from the tenth to the fourteenth day after the receipt of the injury; and this hæmorrhage is, so to speak, irrepressible — nothing to stop it, no natural way to stop it by the forces of nature. The vessel is ulcerated; a ragged opening is formed, which communicates with the sinus. Blood is poured out,

does not have power to coagulate; and the patient may have a fatal hæmorrhage, provided the ball happens to have bruised a large vessel.

Nicking a vessel is also common, and the consequence of that is the gradual formation of a traumatic aneurism. Take the femoral region. Suppose the ball passes through Scarpa's triangle, passes along the large femoral vessels. At first no external hæmorrhage of any consequence. The ball cannot be traced and found. The limb is done up, and suddenly begins to expand far more than can be accounted for by the bruising of the injury, and a large aneurism is formed.

The nicking of a vein may give rise to a sort of traumatic venous aneurism, the pouring out of large quantities of blood in the tissues.

Secondary hæmorrhage, then, is one of the real dangers always to be considered in the prognosis and in the care of the gunshot wound for the first fortnight after its reception. Not showing itself at first, totally buried out of sight beneath the tissues, it is very deceptive, insidious and dangerous; and I do not know any other class of wounds in which this occurs nearly so frequently as by a ball. Of course, it is possible to conceive, and it occasionally occurs, that a compound fracture pricks or wounds a vessel by a spicula of bone, and after a fortnight or so the same consequences of secondary hæmorrhage come on; but in the treatment of compound fracture, where we have the patient under control, the early closing up of the wound and antisepsis frequently convert it into a simple fracture, and it is possible the vessel may repair without bursting through. Not so with the gunshot injury. Not that these accidents are so extremely common; but it should be borne in mind by the surgeon as one of the gravest accidents that

can happen, and one from which no gunshot wound is free, until it is healed.

Septic absorption, of course, is not infrequent after gunshot wounds received in war. Occasionally it occurs after those received in times of peace; but in times of peace the patient can be so much better taken care of that his chances of sepsis are less. Shot down on the field of battle, always in the heated season of the year — for all battles are fought in the summer as a rule; frequently lying exposed for twenty-four or forty-eight hours in the hot sun without attention until his wounds become inflamed; and then carried off and transported in a rough way, it is not surprising that septic conditions follow gunshot wounds in times of war. This, of course, is especially liable to occur where the ball has penetrated and buried itself in the marrow of one of the long bones, where the fat-cells and the tissues in the marrow are bruised and hæmorrhage has taken place, and where there is, as we know, a very easy route for septic absortion to travel up.

Tetanus is much more frequent after gunshot wounds than after other injuries; and after several of the battles of our late war the statistics show a very large prevalence of tetanus, because the patient lay exposed for an unusual length of time in the heat of the sun, the nervous system became thoroughly exhausted, absorption of dirt germs ensued, and tetanic symptoms came on.

Osteomyelitis, of course, is common after gunshot wounds. Here is one of the great troubles in the subsequent treatment of such things as gunshot perforations of the tibia and of the femur. The ball goes in and lodges. It breaks up, as I said, the marrow, splits up the bone, and leads to necrosis inside the bone, the formation of a sequestrum, the gradual forma-

tion of new bone, and the usual phenomena of the opening of sinuses, getting rid of sequestra, etc., which may go on for years, and may wear out the patient's life.

The risk of sepsis, of tetanus, and the chances of secondary hæmorrhage, together with the fact that the rifle missile splits up the bone and destroys much farther than we can see, are the great reasons why the law of practice with regard to amputating or not amputating in certain injuries is so very different in military life and gunshot wounds from what it is in civil life, and in wounds inflicted by other destructive forces. You have got to consider that you have your patient with an injury of the bone farther than you can trace it; that he is subject to osteomyelitis, to septic absorption, that he has got to be moved; that his artery may be bruised and may bleed; and then you have got to ask yourself whether conservatism is to be considered a conservatism, which is going to save such a limb, or whether it is not more truly conservative to cut it off. I fancy, that during our late war, all those who were in the field, and who saw a good deal of service, suffered much from criticism at the hands of civilians because they were accused of performing needless amputations. "This man's limb might have been saved." "That man was not hurt so badly but what he ought to have got well and had a good limb." I contend that the person who looks at this problem from the side of civil life does not understand it; and probably too few, rather than too many amputations are performed in the time of war. Consider what it means to transport a compound fracture, in a hot climate, two or three days over the rough roads before it can be attended to; on the other hand, consider how the person with an amputation nicely done up can escape hæmorrhage and sepsis better than in any other way.

V.

GUNSHOT WOUNDS.

The first point of which I wish to speak is the almost impossibility of applying the antiseptic treatment to wounds received on the field of battle. Anæsthetics, in the form of chloroform, can be very easily transported; so can carbolic acid and corrosive tablets, and all other agents of that class. What, then, would constitute the difficulty in using these? It has always seemed to me that an insuperable difficulty existed in the fact that we cannot obtain sufficient water. An immense amount of water is used in antiseptic solutions — must be. The drainage and bathing of wounds, the dissolving of the poisons which are used as germicides, etc., always require much dilution. Now water is the great want on the field of battle; and unless a battle happens to be fought on the banks of a river, it is easy to see that horses and men soon consume all the water within reach, and there would be none left for antiseptics; and it would be impossible to transport it. It is bulky and heavy. Until some other method of antisepsis is found, not requiring large dilutions, it seems to me that the antiseptic problem cannot be thoroughly solved on the field of battle. Undoubtedly a good deal more can be done than was done at one time; and undoubtedly in field hospitals and in hospitals in the rear the antiseptic treatment will be carried out. A good deal, too, is accomplished now, which could not be formerly, in the adapta-

tion of plaster-of-Paris bandages in case of fractures in transporting wounded persons. That is much more efficient than the ordinary splint, and can be applied easily.

Anæsthetics, then, we can have. Apparatus we can have to transport the wounded. Antiseptics it seems, at present, as if it would be impossible to apply thoroughly in military surgery.

There is another curious fact, which arises from the things which we have already said, which is this, that in amputations the rule, which holds true with regard to the percentage of recoveries in primary and secondary amputations, is exactly the reverse of what it is in civil life. It is a well-known fact that the pathological amputation in civil hospitals, for instance, in the case of old diseased bone, old abscess or hip-disease, or in case of an injury which has passed through certain stages of partial repair and is perhaps hopeless of further recovery, does better than a primary amputation. It has long been known that a certain adaptability of the system to the requirements and strain of an operation was best obtained by some amount of confinement, and depreciation, so to speak, of the vital forces. On the other hand, in military surgery exactly the opposite is true. The patients who get well, get well in a much larger percentage of cases if the limbs are cut off at once on the receipt of the gunshot wound, than if left to be transported to a distant point; being transported without aseptism, necessarily a certain amount of suppuration accompanies them, and they become secondary operations after a week or ten days, and are attended with much greater mortality. Primary operations in military surgery, secondary in civil life, are the best, where we can have the choice.

We said the other day that there were three places in which a ball did a great deal of harm — one in contact with bone; another if lodged in one of the viscera, especially one of the secreting viscera, like the liver, the kidney, etc.; and the third where the ball had penetrated and remained in one of the cavities of the body. Of the latter we propose to speak next.

By the cavities of the body we mean the cavity of the head, the chest and the abdomen. Of course a gunshot wound received upon the head may inflict precisely the same class of injuries to the skull that any other violent force does. The ball may be a spent ball, and merely inflict a contusion of the bone. In the slighter case, it may glance and make only a scalp wound. In the severer case, it may strike flat and square on the bone, and produce a punctured depressed fracture of the inner table without much damage to the outer table. This is familiar in civil life, where small heavy objects fall from a height upon the head. A spike or portion of the rigging of a ship sometimes falls from a considerable height and strikes the head, cracks and splinters the inner table, and inflicts a serious injury on the membranes, and leads to subsequent necrosis of the inner table and all its consequences, when that process is set up inside the cranium. So the ball may do the same. Going a step further, it may penetrate and be lodged in the brain; or, in an extreme case, may perforate and be shot through from side to side.

The mortality of these cases is very great; and in our late Civil War 4,350 gunshot injuries of the cranium were tabulated. Contusion gave a mortality of 16 per cent.; fracture of the inner table alone, punctured depressed fracture, 95 per cent.; depressed fracture, 35 per cent.; pene-

trating and perforating fractures, 80 to 85 per cent. So that it appears that where the skull is bruised and the inner table punctured, it is more dangerous than when broken over a large area and depressed, probably because the damage inside is not recognized promptly; whereas in a depressed fracture everybody feels the depression and sees what has taken place; and knows that what it is proper to do is to raise the bone. Trephining is done, and the wound washed out, with better results. Again, the penetrating and perforating fractures gave a mortality of 80 to 85 per cent. One would think it a wonder that 15 per cent. should recover after penetrating or perforating fracture; and yet instances are on record where a ball has been lodged within the cranial cavity, and recovery taken place, and the patient carried the ball there for years. Those cases are extremely rare, but they do occasionally occur. Better is it for the patient, of course, as regards the chance of any irrigation, drainage and care, that the wound should be perforating; and there is a little better chance if he is shot through and through in the upper part of the cerebrum than if he has a penetrating wound where the ball lodges and may descend toward the base of the brain, and lead to extravasation or softening near the ventricles.

The ordinary rules of surgery apply to gunshot wounds of the head. Cleaning and enlarging scalp wounds, bearing in mind that foreign substances as well as the ball have been carried in; looking out for punctured injuries of the skull; where symptoms arise, trephining promptly and raising depressed fractures; cleaning out traumatic sinuses; and, of course, occasionally, in these modern days, one would be tempted to do the more extensive operations on the skull,

as trephining and attempting to extract a ball. This extraction of a ball must be extremely difficult and uncertain; it is not often to be reached. In old times it was regarded as so hopeless that I do not think the attempt was made. In modern times we should be more likely to try to reach it.

Now, in the gunshot wounds received in the chest, the Civil War gives an enormous number: 8,715 penetrating wounds of the chest are reported and tabulateed. That means that a great many more thousands probably were shot through the chest and died within a year or two unrecorded: and that these were the smaller proportion, who escaping immediate death, afterwards entered hospitals, were treated and accurately recorded.

The percentage of mortality is very large, as high as 60 to 70 per cent.; and it is not immediate, but subsequent changes that take place in the thorax which cause this great mortality. We all know that we occasionally see at this date, twenty-five years after the war — I know of one or two instances — individuals living who have been shot through the chest, and still go about, and are quite interesting objects to physicians, because they have unhealed sinuses through which air is freely drawn when they breathe, and through which a small amount of pus escapes, giving rise to necrosis of the ribs. These cases exist. They may live up to the natural limit of man's life. Of course, they are brilliant exceptions. The majority of people who are shot through the chest have some secondary pathological change take place which carries off 70 per cent. of those so injured, not one-third escaping.

In the first two or three years after the war a great many cases of brilliant recovery after gunshot wounds of the chest were reported; but as time went on, it was noticed, that,

information being accurately obtained from the Pension Department, the mortality kept increasing, and that you could not assume a recovery from a gunshot wound of the chest unless five to ten years had elapsed. Of these secondary changes, the more rapid are in the form of pleurisy and empyema; next, pneumonia; next to that, gangrene and abscess; and finally, most chronic of all, the occurrence of tubercles and of pulmonary phthisis, as a remote sequence of the injury.

If a person is shot through the chest, and the ball has penetrated the lung, of course the signs of the injury are similar to what they would be from any missile received in that way in civil life. We have the rapid coming on of pleurisy and impaired respiration. We have emphysema around the track of the wound. We have cough, and almost invariably profuse expectoration of blood. The coughing up of blood in penetrating wounds of the chest is almost pathognomonic of laceration of the lung. The lung tissue having been injured, the blood escapes into the air-vesicles and smaller bronchi, and is coughed up in greater or less quantity.

As a curious matter of history, during our late war a mode of practice came up, which existed only a very short time, which was based on the supposed harmlessness of the ball if lodged in the body and allowed to become encysted. This mode of practice was to wash the gunshot wounds of the chest superficially, and seal them up at once with some tight material, as flexible collodion, and endeavor to make the surface heal, and to close the track through which the ball had gone. One surgeon carried this on to a very considerable extent. But the success of this treatment was so small that it was a very short-lived method; and finally, if I

am correct, orders were issued from the surgeon-general's office forbidding that mode of treatment to the surgeons in the field. The results were extremely disastrous. It would seem as if the thorax was the most unphilosophical place in which such a mode of treatment could be adopted. A wound would be better treated in that way, almost anywhere else, than here. A bullet shot into the chest may go through the pleura, break through the costal pleura, perhaps enter the lung; it carries in dirt and bits of cloth and perhaps other foreign bodies, produces a lacerated wound which is contused and somewhat burnt, and which will not heal, as a rule, even if it is shot through the arm or a fleshy part of the body — much more cannot heal when in such a complicated place as the thorax. We have the functions of respiration, movement of the lung, chance of invasion of germs of all sorts through the pulmonary tract and mouth, as well as all the other chances of poisoning that must arise. We almost inevitably have emphysema, pleurisy, pneumo-thorax, sometimes empyema; and, very often indeed, an injury to a rib in the passage of the ball in. If the soldier at the moment of being struck happened to be raising the arm to fire, or be inspiring freely, the ball might slip in without striking a rib, but in other positions the ribs would be more closely in contact, consequently there would be apt to occur either a small crumbling off of the edge of the rib, or a tearing off of the periosteum and bruising of the rib and necrosis. This should forbid the sealing up of the wound, even if there were no deeper injuries.

It would seem to be hopeless to hunt for a ball in the thorax; and I believe it is practically abandoned. If the ball enters the pleural cavity and stays there, it drops to the bottom of the pleura and may rest upon the diaphragm. If

it enters the lung, it is almost or quite impossible to reach it; and unless it happens to have smashed two or three ribs, and made so much destruction that the surgeon makes a large opening, and unless it happens to be partially spent so that it has not penetrated very deeply, it is practically not recovered from the thoracic cavity. It may get into some quiet corner and become encysted. It is more likely to provoke an empyema, or changes in the lung itself, especially pneumonia, or, eventually, tuberculous changes.

A very large number of cases of gunshot wounds of the chest involve the cutting through of the intercostal artery. That, you can see, would often take place. From this artery, although it is not a very large one, profuse bleeding can take place; and when it bleeds, it bleeds into the cavity of the thorax. The blood spurts from the artery without restraint, and pumps one side of the pleural cavity full of blood, so to speak. In fatal cases where the hæmorrhage has not been secured, enormous quantities of coagulated blood have been taken from the pleural cavity, probably a quart or more. This injury is fatal, of course, unless the hæmorrhage can be arrested; and yet in civil life we consider that the intercostal artery, if cut in an operation, is not an artery of the greatest magnitude, and it would be thought very strange, if it could not in some way be secured. But the danger in these gunshot wounds is that the wound is not examined, the hæmorrhage is not recognized on account of the multitude of the wounded who have to be seen to and treated. The soldier may lie out long enough to have a fatal hæmorrhage occur, and the signs of its coming on may be complicated so that the surgeon may not recognize what is taking place. The blood may be slowly poured into the pleural cavity, and the lung gradually compressed, and the patient

thought to be suffering from the ordinary serous effusion coming on rapidly after the occurrence of the shooting. The rapidity of the dyspnœa, accompanied with signs of loss of blood, internal hæmorrhage, should be our guide to suspect this injury. The signs of internal hæmorrhage are pallor and faintness and nausea, and also, towards the close of life, an extraordinary restlessness. These are the signs of fatal hæmorrhage that we see in civil hospitals occasionally, in severe cases; and they would exist in hæmorrhage into the pleural cavity, plus dyspnœa rapidly coming on.

What shall be done? If it can be seen early, it may be cured and the patient's life saved. If it is seen later, the patient's life may be saved, but at the expense certainly of empyema, for the clot will disorganize and eventually change into pus. The treatment, of course, should be to secure the vessel. How is this done? The vessel is hidden and retracted behind the rib, and you have a small penetrating wound to reach it through. Free incisions, then, to enlarge the wound; resecting a portion of the rib, securing the artery at all hazards. Some surgeons have succeeded very well where other means were not at hand by passing a curved needle threaded with wire suture directly around the rib, and tying down rib, artery and all together. That is a good temporary tourniquet, and does no harm. It will do for a while, and perhaps will stop the hæmorrhage permanently. It does not take long to establish a clot in a small artery; and, if the patient can be kept quiet, hæmorrhage may not come on again. Ordinarily we should enlarge the wound; explore with the finger; remove broken bone; if out of reach, resect the rib until we could tie the vessel; and having made a large opening into the pleural cavity, it would be proper at this stage to try to wash out and clear out as far

as possible, and treat the wound as an open case of empyema.

So treated, the patient will probably recover. It is a little startling to consider that so small an artery as the intercostal has been the cause of so great mortality in the perforating wounds of the chest. The number of cases is very large indeed.

As for the other treatment of these gunshot wounds in the chest, not much can be said except what applies to all forms of thoracic injuries. It is desirable to syringe out and cleanse the track of the ball. The ordinary treatment for pleurisy and empyema should be adopted as we are accustomed to see it in civil life. Hæmorrhage from the lung is best controlled by quieting down the respiration as much as possible, by enforced confinement of the patient, by the use of ice. I should hardly think the domestic remedies and others ordinarily given for hæmoptysis in consumption would be of any avail in a lacerated lung, lacerated by a ball and bleeding into some of the bronchial tubes; but, if we can slow the pulse by appropriate remedies, quiet the respiration, keep the patient still, use ice, perhaps gallic acid or ergot, we may have some effect in checking the bleeding.

What is going to stop the bleeding? Well, of course, the formation of a clot. The formation of a clot is what we hope for. What is to be the future destiny of that clot? That is extremely uncertain; so that, although the coughing up of considerable quantities of blood after a gunshot wound of the lung, meaning perforation of the lung, may be controlled or may diminish and cease under certain sorts of treatment, yet we cannot feel sure that it will not be resumed again in the course of the next five to seven days by the loosening of that clot and the resumption of the more active

function of the lung; or the decay of the clot and in that way the hæmorrhage recur. On the other hand, it is easy to be seen that the track of a ball through the lung, even if it does not lead to great external bleeding through the mouth, lacerates many vessels, and leads to the formation of numerous miliary clots through the lung itself. The destiny of these, again, it is difficult to predict. In a very healthy person they may be absorbed, and in a person not healthy they may lead to precisely those changes in the lung which the infarction of the lung does in embolism, in pyæmia, and septic states; and the patient may perish with septic symptoms about the second week after the receipt of the injury. Chronic pneumonia may come on, and go on to slow absorption, or run the patient down into phthisis. It is not strange that, while early treatment of these cases gave a good percentage of recoveries, five years afterwards there should be a large percentage of deaths.

We come next to the abdomen. Modern surgery has thrown some new light on perforating wounds of the abdomen, and given us some hope in new methods of treatment.

We may divide these gunshot wounds about the abdominal cavity into three classes: First, those that do not penetrate, which glance over the abdomen, leave a large ecchymosis, and if the ball is large, lead to rupture of a viscus in the abdominal cavity; the next class, those which actually penetrate the abdominal cavity, with or without penetrating one of the viscera; and the third class, where the patient is shot through and through.

Now it is a curious fact that a soldier in health, if he has not been reduced, has been well fed, is in a first and well-conducted campaign which has not lasted too long, having slept in the open air for weeks, marched and got strong and

firm, is in a physical state in which he will resist an intense injury just as any animal will, and make recoveries not to be dreamed of in civil life, or in cities. A case was reported recently in our medical journals of a soldier shot through and through. He was in fine physical condition. The ball entered behind, just below the diaphragm, and came out near the umbilicus. He recovered without any surgical interference.

What happened on the receipt of this gunshot wound of the abdomen is shown by what occurred soon after the receipt of the injury — jaundice, blood in the alimentary canal, discharged by the rectum and showing wound of the intestine; blood in the urine, showing that the kidney had been wounded; and vomiting of blood, showing that the edge of the stomach had been struck. He survived it all. The ball went through and through. He recovered at the end of twenty-eight days without any surgical operation having been performed.

In the older surgeries you will find that, as a rule, abdominal injuries were all given up to expectant treatment, so-called; that is, you cleansed as well as you could, kept the parts quiet, tried to check peristalsis by the use of opium, and trusted to time to accomplish what it could.

Now it is not every ball that goes through the intestine that causes extravasation into the peritoneal cavity. Some do; some do not. As they pass through and through, the mucous coat of the bowel pushes out of the wound and forms a pouting, like the little mass of granulations you see upon old sinuses, and thus plugs the wound; and if peristalsis is held still, it may be plugged permanently, and no extravasation take place.

Hennen and Larrey give a full hundred cases in their

experience, where the patient was shot into the bowels, the ball disappeared, and was passed by the rectum after a certain length of time.

Gunshot wounds of the bladder, as you know, have been quite a number of times the cause of a formation of calculus around the ball, and the ball found in the centre of the calculus when the patient subsequently has been operated on for stone in the bladder; so that cases are to be found over and over again in all the old treatises in which penetrating wounds of the abdomen, the peritoneal cavity, the intestines, the bladder, have been recovered from. Not that this should discourage us from operating. I only say this to show that, while laparotomy is so popular as it is, we still have a certain percentage of cases which will recover without it, and give us some hope if that operation cannot be done.

The statistics of laparotomy for gunshot wounds of the abdomen up to two years ago in New York City, which was, I think, the first place where successful laparotomy was done for gunshot wounds of the intestines, are given by Dr. Bull as follows: cases treated without operation, 1876 to 1884, in the Chambers Street and New York Hospitals, mortality 76.4 per cent.; cases treated by laparotomy, 1884 to 1889, Chambers Street and New York Hospitals, mortality 76.9 per cent. Absolutely the same. He gives statistics of the Roosevelt Hospital: without operation, mortality 85 per cent.; with operation, mortality 81 per cent. I mention these things not to discourage you from interfering, but to call your attention to two points: one is that people get well sometimes without operations; and in the second place to try to point out the particular reasons why we may fail after a laparotomy for a gunshot

wound, and why there are so many chances against us. Later statistics may reverse all this.

In the first place, we have always in the penetrating wound of the abdomen intense shock. That is against us a good deal. The patient collapses early, within the first two or three hours usually. It is one of the signs of the injury. There is a little hole! You cannot be always sure whether it has gone in. Presently the patient begins to sink. It has gone in, and probably internal hæmorrhage is taking place. The operation has to be done in a state of shock, as a rule. Why? Because we cannot afford to wait for an hour or a minute, if we are going to do any good. Either we must decline to operate because the patient is too far collapsed, or, if we are going to do anything to avert peritonitis and arrest mesenteric hæmorrhage, we must do it at first; and all statistics, so far as they have gone, if they prove anything, prove this, that it is the early laparotomies that have saved the cases, and the later ones that have been fatal. A good many cases have been operated on after twelve to sixteen hours; they are usually fatal; that is the reason. On the other hand, the most successful ones, just as in strangulated hernia, will bear an exact ratio in success to the length of time during which the strangulation has existed, or the wound has existed. We have great shock, and must operate in a state of shock.

The next difficulty is this: we open the abdominal cavity, and have got to have a prolonged operation. It is pretty well established, I think, that the success in opening the abdominal cavity for ovariotomy, or any other procedure there, is proportionate to the briefness of time and the degree of exposure to which the bowels are subjected to

the air, or changes of temperature, or dryness; and a gunshot perforating wound of the abdomen means a prolonged operation. It is inevitable. This must inflict a very great secondary shock on the patient; and there are comparatively few who can stand it and survive beyond a few hours after the completion of the operation. I merely instance this to insist upon the fact that the surgical treatment of gunshot wounds of the abdomen by laparotomy must always be accompanied with intense risk. It is a risk we have got to take. The operation always must be done promptly and in a state of shock; it always inflicts severe secondary shock on the patient; and I think the percentage of recoveries will be, for a long time to come, small. At the same time, I would not discourage you from attempting it; because in many cases it is imperative that it should be done. You need not, however, despair of the patient because it cannot be done; because sometimes such cases pull through without operation.

In case an operation is done, there are various difficulties that present themselves. It is easy enough to find the opening in the abdominal wall, put in a guide, enlarge the wound, open the abdominal cavity freely and see what you can find. You find a difficult hunt before you, of course, — the intestines coiled about; hæmorrhage taking place in two or three obscure points far back towards the mesentery; frequently vessels of the mesentery injured near the spinal column; and then the finding of perforations. There are two methods: one proposed by Dr. Senn, which is to inflate the rectum with some innocuous gas or air, and see if it can be detected escaping at some point in the abdominal cavity, thus guiding you to the wound; the other method is to turn over, and search over, the entire abdominal contents. That process

has been named evisceration: a terrible name; but, according to the directions given by some surgeons, it is practically what is done. The intestine is searched from end to end, turned and brought to the light — a lengthy, difficult process, involving terrible shock and terrible delay and terrible exposure; and few patients, of course, can survive it. After all your care and searching, it may happen that a little point has escaped, which is subsequently the seat of hæmorrhage or extravasation. Moreover, to be enumerated in the difficulties, is the fact that you frequently find three or four loops of the intestine lying upon each other, perforated through in six or eight holes. It is an enormous task to repair them; bringing the peritoneal surfaces together so that they will cohere: and it is a long task and one very trying to the endurance of the patient.

Hæmorrhage is found in almost all the cases, considerable hæmorrhage. When you think of the vascular distribution to the intestines, how copious it is; when you think how closely they are packed together, it seems as if vessels could hardly ever escape in the passage of a ball into the abdominal cavity. They do not. Three or four bleeding points are almost always found. If the viscera are not penetrated, death may take place simply from hæmorrhage, provided the bleeding is not arrested by operation.

We have the intense shock at first, then the signs of faintness from hæmorrhage; and if the patient lives long enough, the lightning-like process of peritonitis, which is intensely painful; and, finally, death by collapse on the second or third day.

It is difficult sometimes to say when a little bullet-wound exists in the abdominal wall, into which the probe passes freely, whether the ball has wounded viscera or vessels. It

is impossible to tell at first. We then are forced to rely upon constitutional symptoms. What occurs, and what takes place subsequently? Hæmorrhage, increasing collapse and restlessness, tympanites.

Now probably the safest rule is to be guided by the point whether or not you are sure that the wound goes into the peritoneal cavity. If in doubt, what harm in cutting down on the track of the ball through the muscles to the fascia and beyond, and seeing whether the peritoneum is intact? If it is intact, you have done no harm. If it is open, you have done the right thing. I am strongly in favor of immediate incisions to trace the ball, and see whether it has entered the peritoneal cavity. If it has, I should be guided by the amount of collapse how much farther I would go. If the patient was in such a condition that it was almost sure he would die in a half-hour after the operation, I think I would stop and not persist; but if there was a chance that he might come through, and if he and his friends assented, I should slit up the peritoneum and go in, and search. I am inclined to think the method of Dr. Senn in a modified form will have quite a wide application. I cannot see how it can do any harm after you have opened the peritoneal cavity. I think it occasionally may be a valuable guide. I do not think the use of any particular gas is essential; for air sometimes does exactly as well; or even some innocuous fluid, like a large enema of a very weak antiseptic solution.

When a person has received a gunshot wound of the abdomen, it is our duty first of all to administer stimulants, and try to overcome the temporary collapse; then to enlarge the wound into the abdominal muscles and trace it down to its point where it enters, or does not enter, the peritoneum. If it does not enter the peritoneum, anxiety is practically over.

If it does, then it seems to me the wound in the peritoneum should be enlarged, modes of insufflation or enemata tried to detect the perforation, vessels secured, and attempts made to repair the damage. But if a large ball moving with a good deal of force had penetrated thoroughly, and we found considerable injury to the viscera, I should reflect, and should say, that the chances of recovery by present statistics were not large.

A good deal of discussion has taken place recently as to what you had better do first, after opening the peritoneal cavity. Well, common-sense, it seems to me, settles that. Hunt for hæmorrhage first of all; look for bleeding-points. You will inevitably find some; always some clots in the abdominal cavity. Turn them out, turn the viscera over, secure bleeding vessels, wash out, and then seek for the points of perforation. Occasionally, to our dismay, we find that something has been penetrated which is hopeless of repair. For instance, the ball may be imbedded in one of the solid viscera; and then death is pretty sure to take place; because, even if it is extracted and hæmorrhage arrested, we have an impaired viscus, which is going to repair imperfectly, and finally make an abscess, and discharge its contents inside the abdomen rather than out; so that recoveries from such injuries are hardly to be hoped for. I should think it would be wiser in these cases always to leave a glass or hard-rubber drainage-tube in the wound. It seems to me it must be poor policy to close up a lacerated wound in the abdominal cavity where we have had to stop hæmorrhage and repair perforations. We know from the treatment of tubercular peritonitis, for instance, that the abdominal cavity will stand a good deal of washing out, and be benefited by it; and it seems to me that washing out and drainage are the salvation after the

leaks have been secured in the gunshot wound of the abdomen. Why glass or hard-rubber or some inflexible material? Because the rubber drainage-tube is very soon collapsed if put into the abdominal cavity. The viscera roll about and change place, and the rubber drainage-tube gets twisted and is wholly ineffectual. Glass probably is the best material. Even with the best material, I contend that no means has yet been found for perfectly draining and irrigating the abdominal cavity; and I have some fears that it never will be found. Consider the pockets and sinuses and intricacies of the abdominal cavity, especially down towards the pelvis where accumulations take place; and then consider the fact that in all probability a certain amount of peritonitis is surely going to take place from the wound, from the operation, and from the general interference with the part. This peritonitis in its mildest form, even although it is not dangerous to life, is going to make adhesions at once, in six, or even in two or three hours or less. Where the intestine lies exposed an hour, it is sometimes difficult to pick it off from the walls of the abdomen — almost as if covered with some adhesive mixture. The adhesive inflammation is almost immediate. Now consider the facility with which certain corners and places can be promptly shut off from drainage. This is the difficulty, it seems to me, in attempting to drain the abdominal cavity, and a difficulty which, I am inclined to think, will never be perfectly overcome. Later treatment is by the salt solution.

With regard to the propriety of amputating or not in gunshot injuries, the rules enunciated by the older military surgeons are still very sound; and they are best set forth in Larrey's "Surgery." It seems to be pretty well established, where the femur has been badly broken up and slit by a

Minié ball, that amputation gives the patient a better life afterwards than treating it as a compound fracture; for subsequent necrosis almost invariably occurs; and from necrosis of the femur, even in civil life, you know complete recovery is a rare exception. People may not die of it; but they do not get well. It recurs over and over again, with repeated abscesses and sinuses for years. Then another point is excision. Now excisions of the lower extremity cannot be done in military surgery with much success unless the patient can be in a permanent hospital. In excision of the knee, the only cure is by anchylosis; and so, generally, of the lower extremity. We must have immobility. Excision of the elbow is a far different matter. Excision was practised in our late Civil War, in the armies in the field, in attempts to save limbs. On the lower limbs it was very unsuccessful; in the upper limbs very successful and very promising indeed; and large numbers of soldiers are still living after excisions of the shoulder and elbow, that were done almost immediately after they were shot.

VI.

INJURIES TO BLOOD-VESSELS.

THE word "hæmorrhage" is one which conveys to the popular mind always a great loss of blood. We use it to mean almost any loss of blood; and we are so accustomed to seeing moderate quantities lost that we become habituated to it. The quantity which is lost is always exaggerated in the popular mind. The color and the diffusibility of this red fluid always make a great display, and the loss appears often to be much larger than it is. The public have no fear of bleedings when they come from certain places, and they have great fear of them when they come from other parts; whereas, probably, in a given state of the constitution, it is equally unfavorable wherever the blood comes from. The public are not afraid of a nose-bleed, but they are afraid perhaps of a little blood coughed up from the bronchi, or passed from the urethra.

It seems to make a great difference whether the system has become habituated to a certain loss of blood, and also, whether it occurs slowly or rapidly. If it occurs slowly and repeatedly, the current of blood in the body, in the vessels, becomes filled by the absorption of serum. The tension is kept up. The heart is able to keep up its action; and the patient will live quite a long time with gradually repeated small losses of blood, involving the destruction, or the loss, of a great many red corpuscles. On the other hand, the sudden gush of a number of ounces, in a consti-

tution which has previously had no training in this regard whatever, is very severe. We know, however, that in the female sex, once a month, there is an habitual hæmorrhage, which is often considerable in amount; which is preceded by local congestion; followed usually by feelings of relief after it has occurred; and which not only does not injure the system of the female, but apparently does it good, and is even consistent with health while lactation is going on; so that the person may even be nursing and losing nutriment from the blood in that way, still also have her menstrual flow, and yet not be disastrously affected by this double loss.

Nature has three ways of arresting the bleeding from the wounded vessel, in an artery, for instance, where the bleeding is most rapid: first, the shrinking of the vessel; next, the coagulation of the blood; and, third, the faintness induced, and the diminished power of the heart's action in driving the blood through the vessels.

The shrinking of the vessel, in itself, is quite sufficient, in small arteries, to stop hæmorrhage; and we are all familiar with the fact, for instance, in the wound or freshly-cut surface in an operation, that, if it is exposed to the air, or suddenly treated with the application of ice-water or very hot-water, an immediate shrinking of the vessel takes place sufficient to prevent entirely the leaking. In proof of this, also, is the well-known fact that bleedings which stop at such a moment may recur an hour or two later from concealed, unsecured, undiscoverable vessels, when the patient has got warm, when reaction has come on, when the circulation is restored, and when the vessels again resume their natural strength; so that this conservative effort of nature is the first which takes place on the section of a vessel, and

its being exposed to the air or other agencies, as heat or cold. And the changes are very marked. The vessels have great power to shrink, and they retract into their sheaths; they diminish in calibre, and they check at once the hæmorrhage.

Next comes coagulation, which always takes place in healthy blood in an open wound; and in the shrinking vessel it takes time for the coagulum to form. It is a familiar fact, no doubt from observation, that on looking over the cut surface during an operation after the bleeding has been checked, and the wound is nearly ready to be done up, that the surface is dotted here and there with minute points, which sometimes project out into the air, and sometimes are covered over with slight bits of muscular tissue; those are clots, coagula formed in the mouths of vessels, which lie there, and seal up the vessel from further bleeding.

Next to these, faintness is a very important factor in checking hæmorrhage, and undoubtedly saves more lives in accidents, where sudden bleeding occurs, than any other agency. The patient is severely cut, bleeds freely, staggers and faints, falls down; perhaps the heart almost ceases; while during that time, the blood-current being so extremely slowed and feeble, coagulation readily occurs even in the mouths of large vessels; and it is not infrequent that hæmorrhage is thus stopped, and the patient's life perhaps saved without interference from any person. This, I think, is especially true of those hæmorrhages which take place sometimes quite copiously from the rupture of a varicose vein in a varicose ulcer. The vein ruptures, blood is poured out with great freedom. It runs out in a steady stream until the patient faints. The action of the heart being diminished, the bleeding becomes checked first through the

arteries, then through the capillaries, finally through the vein itself. Coagulation readily takes place, and the vein is stopped; and the subsequent recurrence of the circulation is not sufficient to break away the clot; so the majority of cases of ruptured varicose veins are not fatal. The rule is that the patient is taken perhaps in the night, or in the street and falls down, and is found with a large clot lying about the wound; but death rarely ensues.

Shrinking of the vessels, coagulation of the blood and the faintness that ensues from the injury.

Now, also, it has long been noticed that many sorts of wounds which twist the parts, which twist the muscles and twist the vessels and lacerate and bruise, always check the hæmorrhage. A lacerated and bruised wound scarcely bleeds at all. There is rarely any bleeding at all from a wound that has pulpified and torn and wrenched the tissues.

A man was brought into the hospital on Sunday night having been run over by a railroad-train. The leg was crushed up to the middle of the calf in five or six different sections, so that it hung in tatters, three or four wheels apparently having gone over it at different points as the train went on. The parts were thoroughly crushed and mangled. He laid on the track some time, afterwards crawled to a neighboring house where he got assistance. The leg was tied up in a useless way, as regards checking hæmorrhage. In that condition he was brought some three or four miles to the hospital; and he did not bleed, barely stained his clothing. All the vessels were cut off; and this was perhaps as good an illustration as you can see of the fact that torn and twisted vessels do not bleed.

To arrest bleeding, then, we have to do what? Follow solely the dictates of nature. What are these? To encour-

age shrinking of the vessels; to put the limb in a position to diminish the force of the heart; twist the vessels in imitation of nature, if we do not wish to tie them; and to encourage the formation of a coagulum, and leave it a little while undisturbed. We have in position, in pressure, in styptics, a means of stopping hæmorrhage. We have the application of cold, which causes the vessels to shrink and collapse; the application of heat, which also causes the vessels to collapse.

Now a good deal of distinction is drawn with some justice between hæmorrhage from the artery and hæmorrhage from the vein. They are different, and yet there are circumstances where they appear exactly alike. In the typical case, of course, the blood jets from the artery with every pulsation of the heart. It should be of a bright cranberry color. It is thin, liquid, homogeneous, and thrown with a good deal of force. On the other hand, the blood from the vein, which has not been aërated in the lungs, is darker in color, more approaching a maroon, dark red, which flows steadily and slowly with an even current. It has no pulsation. In the typical case, in the open wound, these distinctions might be quite marked; but there are a good many instances which render it impossible to judge whether a given hæmorrhage is coming from the artery or from the vein. An artery may pump against the sides of a deep cut and then well up, and in that way its jet may be entirely unrecognized and not appear when the blood oozes out from the wound. It may be wholly changed in color from the partial asphyxiation of the patient while receiving an anæsthetic. This is especially true and noticeable in cases of operation where anæsthesia is prolonged beyond the first half-hour, and unless the anæsthetic is used with care. One of the signs of want of sufficient oxygen in the blood is the fact that the arteries are run-

ning blood as dark as the veins; and this should at once attract the surgeon's attention to the fact that the patient is not receiving oxygen enough with the vapor he is breathing. Partial asphyxia from long or injudicious anæsthesia, then, may make arterial blood as dark as venous blood; and arterial blood may well up from a great depth without any impulse.

The distinction between the two hæmorrhages is probably of no great importance unless it involves some large vessel, and there is a question of some anatomical peculiarity by which we should be guided to secure a hæmorrhage; but in arteries or veins of the third calibre, the size of the arteries of the palmar or plantar arch, it is not of very much consequence whether hæmorrhage comes from the artery or the vein. It has got to be secured in any event; and that securing is now done by the ligature mostly; and it is applied now, as well to veins as to arteries.

In old times, far back, the means of arresting hæmorrhage were by fire, by heat, destruction of the surface, forming a coagulation of albumen, coagulating blood and albumen and the burnt tissues together, and sealing the vessels up in that way. You are no doubt familiar with the occasional old pictures in which, after amputation, the iron heated to white heat was applied, or there was poured over the surface of an amputation boiling oil, which scalded the end of the stump, and in that way checked the hæmorrhage.

Although it is asserted, probably with some truth, that the use of other means, such as the ligature, was known to the nations of antiquity, yet, if it was known, it ceased to be known during the dark period of the Middle Ages; and it was not until the year 1536, I think, that, if previously known, it was revived, or, if not previously known, it was discovered and used by Ambroise Paré on some of the battle-

fields of the earlier kings of France; and it appears to have been brought into notice about the time of the introduction of gunpowder; for in a historical picture in the French Academy of Medicine, we see a battlefield in the Middle Ages, with tents, and knights in armor, and spears and bows and arrows, and at one side a clumsy cannon being fired, and in the foreground Ambroise Paré surrounded by various mediæval characters, applying the ligature; about this time this event, which marked a great period in surgery, occurred, and Paré proved that one could dispense with oil and with fire in checking hæmorrhage, and instead of mutilating, so to speak, the whole surface of a wound, could tie up the vessels singly in different parts of it, and thereby promote very much the healing, and also check the hæmorrhage more certainly and more rapidly.

Like all new discoveries, if it was new, or like all new revivals, if it was a revival, it usually happens that these are very slowly received. It is said by the old English and French writers that a century ensued before everybody would adopt the new method, and surgeons went on with the old practices many years; but the new method slowly won its way until it became a universal method, and is the universal method of arresting hæmorrhage at this time, though it has been modified to a certain degree. When Ambroise Paré tied an artery, he seized it with a curved hook and drew it out. They had no forceps as we have to-day. He tied it with a ligature, probably of silk or strong thread, and left the ends hanging out of the wound. These afterwards cut through the vessel and came away. This was the method until a few years ago. The instructions were that in case of the large vessels you should draw the knot down sharply and closely until you felt the middle, brittle coat give way, and

secure the knot by another turn, and leave the ends hanging out of the wound. The process which took place was this: the walls of the inner coat of the artery were brought in contact, the middle coat was broken down and the sides forced into contact, and the tough outer coat was folded in. We had, therefore, a closed pouch, into which the heart was pumping blood. Now we know that when arterial blood is pumped against an obstacle it coagulates; its fibrin is deposited; a clot is built up that gradually extends, in a tapering form, some little distance up the artery; and that occurrence having once taken place, the hæmorrhage is effectually arrested; and if this condition of things could be left undisturbed, there is nothing more to be done. Unfortunately, under the former use of the ligature it was always expected, always the rule, that this ligature had got to come away; could not be left there; it always provoked suppuration and ulceration; and could only come away by eating through all the coats of the vessel, leaving it closed as a fibrous cord, and in that way preventing the hæmorrhage. The coming away of the ligature necessarily was a very uncertain event; differed in time as to the size of the vessel. In the small vessel it would come away in five or six days; in the larger vessel, ten days perhaps; in a vessel the size of the femoral or carotid, seventeen to twenty-one days. It frequently hung on three weeks. One was cautioned, then, to tie the ligatures in such a way that the size of the vessel could be indicated by the size of the thread and knots. A large knot indicated a large vessel. A small thread indicated a vessel of moderate size. Why were these distinctions observed? Because you must not touch the larger ligatures, or attempt to separate and draw them out, until sufficient time had elapsed to make it safe to do so; hence it was necessary to

indicate the size of the vessel by the size of the thread or knot. One pulled the little cords each day for five or six days to get them loose, but did not touch the larger ones until a longer time had elapsed.

This is the history of the application of the ligature by Ambroise Paré. This was the mode in which hæmorrhage was arrested; and these the uncertainties and the impediments to union by first intention which, as you must see, was almost impossible of occurrence with a series of suppurating strings lying at various points in the wound, liable to separate prematurely, and thus liable to give rise to secondary hæmorrhage.

The application of the ligature was an immense advance over the old method, which forced the whole surface to heal by granulation. It reduced the thing to this, that you could have partial union by first intention, and have two sinuses through which you gradually draw out your ligatures.

In another sense these ligatures served a useful purpose: and this was in securing drainage, which we seek to secure now by placing in a drainage-tube of rubber or glass. The capillary suction of these strings led all the fluids away from the stump, and drained as perfectly in those old days as we drain now; but beyond that they led to suppuration.

This great improvement of Ambroise Paré finally came into use, say, about the year 1600, and remained in constant use without modification until about thirty or forty years ago. I do not know the exact date. At that time people began to inquire whether there was not some better way in which all this could be secured without provoking ulceration and suppuration in the wound.

Two methods were proposed. One has fallen into disuse; one is still used. The one that has fallen into disuse

was introduced by Simpson in Edinburgh, and called acupressure. This consisted in compressing the bleeding vessels on a steel needle (polished steel, nickel-plated or silver) having an unirritating, smooth surface. This was buried in the tissues, folded over on the vessels, turned and secured very much as you put a pin in the coat to secure the stems of flowers in the buttonhole, the artery being the stem of the flower. This pin was a temporary expedient, and was intended to stay in forty-eight to seventy-two hours. Then it was unpinned and withdrawn; the tissues fell back into place. Forty-eight to seventy-two hours had been sufficient to compress the artery and form a clot, but not to provoke ulceration; and we had healing by first intention, and no hæmorrhage.

This was a great advance; and the method of Simpson for a few years had a great many advocates. It was of very easy application in the stump of an amputation, where you could see all the surface, and pass the pins here and there. It was, however, of rather difficult application in the continuity of an artery; though I have used it, and seen it successfully used, in vessels so large as the femoral. Instead of tying the vessel, expose it and pin over it, through the muscles, and leave it forty-eight to seventy-two hours; then withdraw the needle, and have perfect occlusion of the vessel.

On account of the painfulness and awkwardness of this method, making as it were a pin-cushion of a man's amputated thigh, another method was sought and is still used to a large extent; and that was, simply in imitation of nature's mode, by twisting the arteries instead of tying them — torsion. That is still used in some places and by some surgeons. In some of the London hospitals, Guy's, I think, it

is used almost exclusively instead of the ligature. Special forceps have been devised for the purpose of doing it successfully. These forceps have blunt ends. You see them illustrated in all the modern books. In the case of small vessels it is only necessary to seize and twist them around until you are conscious that you have broken the walls of the vessel. If it spurts again, you twist once more. This method is very successful. Hæmorrhage rarely occurs; and it is capable of a very wide application.

Still the ligature was too good a thing to be lost sight of. It was safe. After you had tied up a vessel firmly with a good square knot, you felt that you had done a safe thing for the patient. Turning might untwist; something might occur when nobody was about, and serious results ensue; so that we could not give up the ligature, and attention was next directed to modifying it; and it has been modified so that it is more successful than all the other methods put together, and does not interfere with first intention. That modification is in making it aseptic, so that there is no need of its ulcerating through the vessel and no need of its being withdrawn. The various forms of catgut perhaps have met this indication better than any other, inasmuch as they tie the vessel, and remain in position, and are absorbed themselves without ever showing themselves in any way. The only difficulty about these seems to be this, that in the larger kinds of catgut it is difficult to get perfect asepticism in the centre of the strand. The surface becomes aseptic but the centre is liable to be in an untreated state, in a rough organic condition, in which it will decay; and the other objection, which I think is more serious, is that, in the first place, it is a great deal harder to tie a good knot — you have to tie three knots to be sure — and then

it absorbs so quickly, that it is not to be always strictly relied on with regard to the larger vessels. It may give way before firm union of the vessel has really occurred. Other materials, as silk, made aseptic by boiling, or by various treatments, is always preferable, and is now largely used. Perfectly aseptic silk is never heard from again. It probably remains encircling the vessel, or becomes slowly absorbed or encysted, and does not make any trouble. Look at the great advantage these ligatures give us in securing first intention, in avoiding suppuration, in diminishing enormously the chance of what we call secondary hæmorrhage.

What is secondary hæmorrhage? Hæmorrhage which comes on during the period of ulceration and suppuration, — not at the time of the wound, not at the time of reaction a few hours after the wound, when bleeding frequently occurs, but ten to fourteen days after the infliction of the wound, when the suppurative process has fairly set in. As we said the other day, when a ball enters a limb and passes across and bruises the coats of an artery, it is not until this burnt and torn tract has begun to suppurate and the walls of the vessel give way, from the tenth to the fourteenth day, that secondary hæmorrhage occurs. Just so, also, in applying the ligature to a large vessel. It is not until it has ulcerated through and has cut its way off and is coming out, that secondary hæmorrhage occurs there; and it occurs from want of reparative power in the vessel, imperfection in the clot, in its organization, reopening of the vessel at the point where the ligature separates. Secondary hæmorrhage is impossible where an aseptic ligature is put on the vessel which stays without provoking suppuration; which never comes away; never relaxes its grip on the vessel; and

around which the reparative material forms just as well as it would if no foreign body were there. It ceases to be a foreign body; becomes incorporated into the tissues, if it is catgut; becomes encysted and slightly changed or absorbed, if it is aseptic silk; and once tied, that is the end of any chance of hæmorrhage, provided the asepticism is perfect and no suppuration occurs. One can see that now, by the aid of this expedient, the modern ligature is far beyond any other possible method of securing hæmorrhages. It is handier than the steel needle; safer than torsion, for the vessels cannot give way; does not provoke suppuration; does not interfere with healing. Consider the great safety of this in certain surgical operations which have to be done in the continuity of a vessel. You can see the importance of it in the large wound made by amputating the breast. You can see if you tie fifteen or twenty of these little threads, and they remain in the breast, if it can be closed up and heal down solid, there is no chance of hæmorrhage, no chance of suppuration, and the advantage is evident. But great as it is here, it is not so great as it is where we have to tie in the continuity of a vessel. Take, for instance, aneurism of the carotid. Here we have to make a wound to reach the vessel: cut down and open the sheath of the vessel, detach it to a slight degree from its minute attachments and the vaso vasorum and the connective tissue by which it is nourished; pass around the needle; get the thread around; tie it down, and arrest the current by a firm knot; and in a vessel so large as the carotid considerable force has to be used. If this ligature can be made aseptic, and is never to come away, we have merely to close the wound: the carotid is forever occluded so that no pulsation can take place through it, and there can be no danger from secondary

hæmorrhage in the separation of the ligature. It is safe to say that by the use of the aseptic ligature the operation of tying arteries in their continuity, to control growths, arrest distant hæmorrhages, control aneurisms — everything of that kind — has been more benefited than any other operation in surgery. One of the great dreads in former times, in the Hunterian treatment of aneurism, was what was going to take place at the seat of the ligature. You had to take not only the chance of suppuration in the sac of the aneurism, not only the chances of gangrene in the limb, if collateral circulation was not established; but was the wound going to do well? Would the ligature come off without giving rise to suppuration and fatal hæmorrhage? Hence it was so much insisted on in former times that, if an aneurism of the lower limb was to be treated by tying the artery, no previous treatment whatever should be employed in the vicinity of the spot — Scarpa's triangle — because if pressure had been used there, it was feared the tissues would be thrown into such condition that the ligature might separate prematurely from the artery, the wound slough and suppurate and secondary hæmorrhage of fatal character occur.

So, now, nature stops bleeding by shrinking the vessels, and we stop it on surfaces where the vessels are capillary and numerous and small, by irrigating with hot fluids or irrigating with cold, causing the vessels to shrink up before the flaps are finally adjusted. Nature coagulates the blood in the mouth of the vessel. We imitate that by tying the the vessel and causing a clot to form inside, which would not otherwise occur. Nature also stops hæmorrhage by faintness and by position of the limb; and these we imitate, to a certain degree, by perfect rest in the horizontal position after a severe operation, careful regulation of the

diet, avoiding anything that will increase the pulsation of the heart, and, perhaps, by elevating the wounded surface itself.

Acupressure and torsion, probably, will gradually become things of the past, so long as the aseptic ligature is as perfect as it is at the present day.

What are you going to do for secondary hæmorrhage? It occurs sometimes. The treatment has to be entirely different from that of primary hæmorrhage. You have got a ragged, sloughing, suppurating, foul wound. You are trying to dress it and make it heal, and suddenly there occurs an oozing from the bottom, a continuous leaking of the blood. The ligature is of no use. It cannot hold upon the vessels. You sponge out this foul cavity, try to clean it out and seize the vessels with forceps and attempt to tie, and the strings cut through and come off as fast as you can put them on. No tissue will hold. You are reduced then, with regard to the wound itself, to adopt pressure and styptics as the sole method of arresting it in the wound; and sometimes these are sufficient. Yet styptics applied in the fresh wound, which has any chance of healing by first intention, are immensely disastrous. They are the last thing that should be used. They irritate the surface, provoke secretions, leave behind them hardened and uncomfortable little coagula, which afterwards have to be thrown off by the suppurative processes. In the hæmorrhage from sloughing and suppurating wounds the effect of styptics upon the surface is of no consequence; the mischief is done; repair has got to be by granulations. A large part of the decayed tissue has got to come away, and a styptic is frequently good to use. Styptics and pressure are the modes of controlling secondary hæmorrhage in the wound itself. Pressure is perhaps the more important of the two.

Of the styptics the least irritating agent that you can use is the ferric alum, which coagulates the blood very quickly, but forms with the clot a sort of sand, which is not very irritating to the tissues. It seems to be quite as good a styptic as the persulphate or perchloride of iron, but the persulphate or perchloride of iron forms with the coagula hard, crystalline, irregular clots, which are extremely irritating. The one forms a smooth sort of tissue, and the other hard, brittle, angular masses; so that ferric alum as a styptic is greatly superior in the wound for secondary hæmorrhage; then use pressure and position and rest.

Sometimes the bleeding keeps on. Then it is useless to do anything in the wound; but you have got to tie the upper, supplying vessel, a few inches away, where you can get at it in healthy tissue, and where you can in that way secure the bleeding — a disastrous proceeding, of course; a proceeding especially disastrous in a limb, because, if you have to tie a considerable trunk above a sloughing cavity, you have thereby not-only stopped the hæmorrhage, but cut off its nutrition, and perhaps induced gangrene.

In regard to securing primary hæmorrhage, the cardinal rule is that you should attack it and secure the vessels where the bleeding occurs; dilate and lay open the wound, and secure the bleeding points wherever they are. Another cardinal rule, first, I believe, brought to notice by one of those sound writers on gunshot wounds, Mr. Guthrie, was this, that if you are dealing with a hæmorrhage from a large vessel, you must tie both ends in the wound, or near the wound, in order to be secured against recurrence of hæmorrhage. For instance, a large artery is wounded. You tie one end and secure the other end, if it can be done. Why? Because the end that you have tied obstructs just

so far the circulation in the limb. That circulation has got to be kept up, and is kept up by collateral circulation, or anastomosis of numerous small vessels, which do not appear to the eye or sight, but permeate about, in and out, among the fascia and muscles, and gradually form a system which supplies the place of the main trunk. This collateral circulation restores the circulation of the blood in the lower part of the limb in a few days. Then what? Then it necessarily communicates with the lower part of the vessel which you did not secure; and in a few days a new hæmorrhage will take place from the lower end, which ought to have been tied at first.

There used to be a great prejudice against tying veins. I think that is almost entirely done away with. It is recognized now that the chance of suppurative phlebitis, or septic phlebitis, from tying veins is not much greater than it is from tying arteries; and that what does take place when a vein is tied is an adhesive phlebitis, which forms a clot, and acts as the artery does; and that usually is the end, not only of the hæmorrhage, but of the process which heals it; a process which bears so close a relation to the inflammatory processes that it is impossible sometimes to draw the dividing line between repair and inflammation. The adhesive inflammation often does not go any further, just as the adhesive inflammation which seals an artery does not go any further; so that it is relatively about as safe to tie a vein as an artery. We would do better usually if the vein is of considerable size to cut it off, and tie thoroughly at the two ends. In secondary hæmorrhage, then, put styptics in the wound, pack, keep it still and lift the limb. If that does not succeed, tie the vessel higher up. In primary hæmorrhage never attack the vessel anywhere except in the wound

itself. Seek for the bleeding points. If it is a vessel of considerable size, also seek for and tie its other end; and tie veins as well as arteries.

It is a very curious fact that the arteries were so named in old times because they were supposed to carry air, and that it is now well known, not only that the artery does not carry air, but that there is no danger of air getting into an artery; but, on the other hand, air may accidentally get into a vein and cause fatal results. The veins were thought to be the blood carriers; arteries carried air. It was thought so on account of the elasticity of the arteries. The expiring act of the heart in dying drove the remaining few drops of blood out of the artery, and when this vessel was opened after death it was found to be empty, and was supposed to have carried air instead of blood; whereas the vein after death was found loaded with blood, and this was supposed to be the circulation of the blood through the veins, and not through the arteries. Now the elasticity of the arteries — the current is forced through with such force — rarely leads to the admission of air into them when they are cut. On the other hand, the entrance of air into large veins is well recognized as being a serious danger in surgery. The vein is thin-walled, gapes easily, is attached in many places to the longitudinal layers of fascia. If these are drawn apart in doing an operation, and the vein cut, the cut edge of it gapes open; and unless the operation happens to be at a point where there are numerous valves, there is nothing to obstruct the entrance of air into the vein; the movements of breathing sucking the blood back to the heart, and also sucking the air down into the heart with fatal result. It is notorious that wounds of the large veins of the neck and axilla are those most liable to be fatal on account of their nearness to

the heart, and the short journey that the air-bubble has to take in order to reach the right side of the heart from the seat of the wound. Most of these troubles have occurred in operations about the neck where surgeons and assistants were so busy perhaps in extracting a tumor, or something of that kind, that they were not noticing the vein underneath; and the vein being thoroughly on the stretch by pulling up the tumor, and then being nicked, air rushed in. It is not, I think, adequately explained what is the cause of death in these cases. One or two small bubbles of air may go in with an audible sound, produce a temporary disturbance, and the patient recover. I have, and every one else who is about hospitals considerably has, seen that occur many times; but if a considerable quantity of air gets in, a fatal syncope is produced. I once witnessed a death from that cause. Sighing and irregular respiration, rapid cyanosis of the face, tumultuous and irregular beating of the heart, are developed in a very short time, — one to one and a half minutes. Now this air goes to the right side of the heart. It either acts by distending the right chamber and rendering the valves incapable of working, or becomes churned up into froth, which interferes with the action of the valves. Those are the two theories by which it is sought to explain the mode by which it kills. A small amount will not kill, but will produce symptoms. A considerable amount will bring on fatal syncope and death in a very short time.

What can be done to prevent the accident? For indeed not much can be done to remedy it after it has occurred, as fatal results come on so rapidly. What can be done to prevent it? Of course, we are cautious about wounding large veins. Pour the wound full of fluid so that air shall be excluded. Better still, try to thumb the vein down by the

collar-bone, near the sterno-mastoid, where the junction of the veins occurs. It is a caution sometimes observed by those who are very careful when operating about the neck, to request an assistant to be ready to make pressure at any time, and to consider that a part of his duties during the operation; that is, where there seems to be a probability of exposing so large a vessel as the internal jugular.

Electricity, stimulants, artificial respiration are the measures which would suggest themselves to try to keep up the heart's action and the respiration until the heart could become accustomed to this strange enemy; but if air has gone in, in a considerable quantity, death is usually the result.

VII.

FRACTURES.

It seems to be quite well proved that in the repair of broken bone the amount of reparative material that is thrown out is directly proportionate to the displacement of the ends; that if the bone is broken square across, is not pulled out of place, if the ends lie in contact, if nothing has occurred to distort the limb, then the amount of reparative material thrown out to mend the break and establish new bony union is extremely small; but if displacement occurs, that nature makes a greater and greater effort to repair the injury by throwing out large quantities of what used to be called provisional callus. This callus is a soft material which cements together and covers over the broken ends of the bone: unites them by an adhesive and pretty firm material, which finally undergoes certain changes. Hence the name provisional callus, meaning not a permanent callus, but a temporary one. This provisional callus is finally reabsorbed; so that although the patient on first getting well from his fracture and going about has an enormous lump over the seat of the fracture, after a few months, or a year or two, it is almost all gone; it tapers out into a smooth spindle-shaped enlargement, which is not very noticeable under the muscles. The outer part of the callus is absorbed; and only that part remains permanent which was necessary to hold the bones together. This seems to be a law of nature. No displacement, little callus; great displacement, immense callus;

provisional or temporary, that is, to be absorbed, after a while.

Where does this material come from? Great disputes have occurred with regard to this point; some people, thinking that the periosteum was the feeding membrane of the bone, the part that nourished it, argued that the periosteum was the membrane which furnished all the elements of repair. Others have proved by investigations that there are a great many other sources from which the reparative material comes; that it is poured out from the Haversian canals, from the broken surface of the interior of the bone itself; that it comes from the medullary cavity we know, because how otherwise could a fractured bone unite solid all through, and have its central shaft restored at a very much later day? It must then be partly formed by the membrane — "endosteum," I sometimes call it — of the medullary canal, or the inner periosteum; it must be formed partly by that. We know it is thrown out by the Haversian canals themselves; and we know also, of course, that it is largely supplied by the periosteum outside. More than that, some authorities go so far as to assert, as the result of experiments on the lower animals, that the neighboring tissues are capable of throwing out reparative material; for instance, the neighboring blood-vessels, etc., as well as the periosteum, bone surface, medullary membrane and Haversian openings. Probably from all these sources, then, reparative material comes.

Now it is a very curious fact that some bones unite with a very little callus, no matter whether displaced or not. This is especially true of the lower jaw and ribs. Fracture of the lower jaw has very little provisional callus thrown out to mend it; but union mostly takes place from surface to surface without much subsequent irregularity, or nodulation, so

to speak, of the surface of the bone. The same is true of the rib. Other bones, which are not bones really, that is, they are not bones in the sense of having all the functions of bones, but are called sesamoid bones, inasmuch as they are merely osseous developments in the sheaths of the tendons; other bones of this class, such as the patella more particularly, cannot succeed after a fracture in reuniting by bone, unless the process is assisted by wiring the bone together; but if left to the natural processes or nature, a fracture of the patella does not unite by bone, never passes beyond the ligamentous stage.

Bones shorten when they join. That is an important point. The amount of shortening depends upon the obliquity of the fracture, the amount of displacement, etc. Bones shorten, however, when they join, although the fracture be transverse. How is this? Because in the majority of cases of transverse fracture the fragments are not afterwards put in perfect position, and although they may be broken square across, still they become displaced from muscular action in the majority of cases, and shortening takes place. It seems to be a universal rule that in fractures of the lower extremity shortening takes place in the repair of a break. This is especially true of the femur (where it is most noticeable) and the tibia (where it is not so noticeable). If, however, only one bone of the lower leg be broken, if the tibia alone be broken, and the fibula remain unbroken, then you must see that the opportunity for shortening to occur is very much reduced, that the fibula answers as a splint to the tibia, holds at full length the limb, and allows the bone to repair. You will also notice that shortening in breaks of the upper extremity would be much more likely to be overlooked and not detected than it would be in fractures of the lower

extremity, because it does not matter if one arm is one-half or three-fourths inch shorter than the other, if it is strong and useful. More than three-fourths of an inch in the lower extremity entails first a limp, then tilting of the hips, and then curvature of the spine and deformity of the whole length of the spinal column.

At first the reparative material is thrown out in soft condition; then it hardens down into something resembling cartilage; finally it becomes bone. It is said by some authorities that it does not always pass through the cartilaginous stage, but passes more directly from the soft state to that of the forming of bone salts and bone cells. In the ordinary run of fractures you will find that there is a very great difference in the time that must elapse in the union of a bone like the femur, so that it is reasonably strong and useful and firm. Such union takes place in the femur in six to eight weeks; but the deposition of bone salts and the restoration of the bone itself is a matter of many months; and sometimes is not completed under six months.

To what is the shortening due? If a bone is broken off and has not much to knock it out of place, why should it so obstinately go out of place as it does? We can only explain this on the theory of muscular contraction; and just how the bone is going to be displaced, in what direction the two ends are going, depends of course upon the very complicated attachment and energy of the muscular fibres which surround the limb. In the femur, for instance, the bone is surrounded by an immense mass of powerful muscles. It is a small bone, but it is buried very deeply beneath a large mass of flesh and muscles. The muscles mostly pull in a longitudinal direction, up and down. At the upper end the rotators twist the fragments in various directions, and even

the psoas and iliacus tilt the fragment upwards and outwards. Muscular contraction makes the displacement; and it is greater of course where there is but one bone, as the femur or the humerus, than it would be where there are two; and the direction in which the fragments will go when they ride by each other depends entirely upon the way in which the muscles happen to pull. Hence, of course, a cardinal point of treatment is to restore the bone to its natural position. The limb must be drawn until the two ends of the bone are put in position, and held so; and the muscular contraction must be overcome in some way. This was done in former times partly by splints compressing the muscles, and partly by various apparatus which acted by means of the screw. In modern times we use extension, the pulley and weight to overcome the contraction of the muscles and draw the part down.

Bones join whose ends are not brought in contact. We see this in cases of fracture of the femur that have occurred and apparently never been treated at all. They will join finally; but with the fragments drawn by each other in the most extraordinary directions. Yet Nature will bridge the whole thing over, without the ends of the bone ever coming in contact at all. We see the same thing in the lower animals. We know that a chicken, a young dog, or a lamb will run about with a broken leg dangling, and in a few weeks it will join, with the fragments far up, ridden by each other, and yet it will be solid. Nature accomplishes the same thing in man, but by longer effort.

Sometimes it happens that perfect union does not occur. Those are the cases that are called non-union of fractures. It is, however, rather a false use of words, I think, inasmuch as non-union of a fracture never occurs. The fracture al-

ways unites, but the point is this, that the cases that are called non-union should rather be called, I think, imperfect union, that is to say, the bones join by a plastic material, but the material never passes beyond the plastic stage, never hardens into cartilage, never ossifies into bone, and the bones are merely fastened together by a soft, flexible material which makes what is called a false joint. Now the bones may be so ridden over each other and deformed that the false joint allows the bones to play about each other like the two pieces of a flail, or play upon each other by a species of false socket. Those are what are called ununited fractures. They are ununited by bone, but they are united by other material. I wish to impress upon you the fact that some sort of union always takes place. With persistent care and judicious measures to assist, almost all the cases of imperfect union, or delayed union of bone can be carried along beyond that stage of imperfect union, and can be made to join in the end. "Non-union," says Hamilton, in his treatise on fractures, "can practically be overcome by patience; and most of these cases, by a proper use of means persisted in long enough, will finally unite by bone."

Nature, then, makes an effort to repair broken bones always. If they are in contact, she has to make very little effort; the reparative material thrown out is small in amount. The callus-lump about the bone is proportionate to the amount of displacement. If the displacement is small, the callus is small. If the displacement is great, the callus is great. It is not permanent; it is subsequently taken away and absorbed, leaving only enough to support the bone. Nature sometimes fails in carrying out the process, but never fails in securing some union of the bone; she sometimes fails in securing bony union, in which case

we have what is called the ununited fracture, which means merely a ligamentous, or fibrous union, instead of a bony union.

No one can doubt, I think, after looking at these specimens of old fractures which I now show you, that Nature possesses almost inexhaustible powers of repair, if we give her the slightest chance to put these powers into action. She does not, however, immediately begin to repair the bones on the receipt of an injury, but a considerable time elapses before repair begins, usually from a week to ten days after the receipt of the fracture. This time is consumed in getting over the shock of the injury and restoring the soft parts to their state before the injury, before repair can take place.

Let us consider what must occur when even a simple fracture of a bone like the humerus or the femur takes place. The same violence which broke the bone must necessarily have inflicted first severe injury and bruising of the soft parts, otherwise the bone could not have been reached and broken. Every fracture, even of the simplest kind, must be accompanied necessarily by a great degree of contusion of the soft parts. Contusion means tearing of muscular fibres, laceration, to a certain extent, of tissue, rupture of small vessels, capillaries and veins, sometimes the rupture of nerves, but not often; and much extravasation of blood about the part. In addition to this, there is almost always a badly bruised skin, which after the fracture becomes mottled with spots and ecchymoses, and also becomes blistered in blebs, and large serous exudations, which take a week or two to subside after the receipt of the injury. All these damages, then, are extraneous to the fractured bone. In the midst of this seat of destruction and injury

lie the two fractured ends, which speedily, on account of the tetanic spasm of the muscles, become drawn by each other, imbedded in the soft parts, pricking all the delicate tissues, rupturing still further veins, setting up most intense nervous excitement by their presence and sharpness, and in that way much aggravating the injury produced at first. Although these bones be promptly reduced, the fracture treated and dressed, it is too much to expect that nature can repair the injury of the bones themselves by plastic material until she has had time to remove the products of effusion and inflammation which takes place in the contused parts around. In proof that a certain condition analogous to inflammation always precedes this repair, we can instance the fact that the bruised parts always swell the first few days after the receipt of the injury. The injury is received, a fracture produced, the soft parts lacerated. At first the limb only appears scarred, and black and blue, but speedily begins to swell. This swelling increases, reaches its height about the third day, stands still a little while; and it is usually six to eight days from the receipt of the injury before the swelling has gone, and the limb has returned to its original size.

The cause of the swelling is an effusion of serum, partly of blood-cells, partly of plastic material in a semi-inflammatory state thrown out into all the neighboring tissues, muscles, fasciæ and cellular interspaces. The skin becomes enormously stretched. The blebs which are formed rupture, and the fluids drench the limb with their secretion. The skin gets irritated and excoriated, and that, together with the increasing blackness and discoloration of the part, due to the slow coming out towards the surface of the effused blood from the deep vessels which have been ruptured, con-

stitute a limb which sometimes looks as if it could hardly recover, and might pass into a state of gangrene and be lost; that is, in a well-marked case of fracture. All this has got to subside. The limb has got to be returned in temperature and size very nearly to the aspect of the other limb before Nature can finally take up vigorously the repair of the broken bone. She has got to repair the other things first. The other things are repaired very quickly. Effusions are taken up almost as fast as poured out. Clots lie indolent in the part and eventually are taken away, and finally only a discoloration remains. The ruptured fibres speedily reunite, and, just as in the ordinary bruise, the limb repairs all its soft parts within the first ten to fourteen days; but the bone does not begin to repair until these changes are well under way, and it comes on as a secondary step, a much longer step and more important; but Nature cannot undertake it until she has restored the soft parts first.

If, then, a bone is not going to unite or begin to unite under a week to ten days after the receipt of the injury, of what consequence is it, it may be asked, that the limb should be set, or the parts be put in permanent position, until the changes which unite the ends of the bones are about to begin. There are several very important reasons why the earlier the fracture is treated and set the better is the probable prospective result. In the first place, you diminish the amount of nervous shock and pain. The bones drawn into place and held there immediately cease to prick the soft parts and produce that violent tetanic pull of the muscles which is so painful and exhausting. In addition to this, it is much easier to get the ends into position at this time than after a considerable time has elapsed; so

that, although we do not expect them to mend at once, the sooner they are set and put in position the better. At the same time this rule must not be held as being too absolute, because in cases which threaten to become sloughing or gangrenous, where the limb swells enormously, as it does in the little child, it is not always safe to put the part in a firm dressing, not allowing for swelling and subsequent extravasation; therefore there are badly lacerated cases where it is wiser, at first, not to attempt to compress the limb, or to hold the bones firmly in position, but to treat it in some soft apparatus in an easy position, relaxed and turned on the side, so that the muscles may not pull strongly. At first treat it by an application containing laudanum, glycerine and dilute alcohol. That is a very good application; laudanum and dilute alcohol (equal parts), and a small proportion of glycerine to make it soft and comfortable to the skin; or a simple evaporating lotion composed of muriate of ammonia, dilute acetic acid and alcohol and water; or a lead wash — something of that kind; putting the limb on the side, not compressing it in any way, covering it with these evaporating lotions and waiting for the swelling to subside. That is not a desirable way to treat a fracture. We do not do it unless we are afraid to use the other method. But there are instances where, if you draw the limb immediately into place and hold it firmly, you will produce such pressure and tightness that the limb will swell and slough badly, and mortification and subsequent amputation may occur. This is no fancied danger. In older times it has occurred a great many times, and I have seen one instance of it myself. This would be especially true in the treatment of fractures of the forearm, where you have a very peculiar state of things as regards the position

of the blood-vessels and nerves. The forearm is covered with blood-vessels, and the two bones lie closely together, joined by a firm interosseous membrane, and it is extremely easy, unless caution is used, to get a destructive amount of squeezing upon these tender parts by the application of splints in the early treatment of fracture of the forearm. The swelling parts are confined between the bones and interosseous membrane on the one side and a firm splint on the other. But one result can follow. Neither of these can give way. The tissues die for want of circulation, and a slough is the consequence.

After a week or ten days commences plastic union of the bones. How long does it take to repair them? This varies very much with the locality. The smaller bones unite very quickly; the collar-bone in two to three weeks, the rib in even a shorter time, the lower jaw in sixteen to seventeen days, the tibia in four weeks, and the femur in six weeks. These, of course, are only averages. You cannot apply these, any more than any other rule of statistics, absolutely to any one individual case; but the rule is that union may be expected to take place in about such a length of time, in such a bone.

Does age make any difference? The differences between adult and old age seems to be very slight. The bones of the very aged unite in favorable localities, when broken not too near to joints. They unite very slowly, but there is not much distinction between adult age and old age. There is, however, a great difference in the length of time required to repair a fracture between adult age and childhood or infancy. About one-half the time is required in childhood or infancy to mend a broken bone that is required in the adult; and the femur, which takes six weeks to unite in the grown

person, will unite in two, two and a half, or three weeks at the outside, in the little child.

How often may we fear that what is called non-union will take place? That is a very serious matter because it can hardly occur without reflections in the minds of the patient and his friends upon the care which the patient has received from the surgeon; and they are very prone to think that, inasmuch as other people's bones join, his bones ought to join if he had had the proper attention paid to them. Statistics prove that ununited fractures fortunately are very rare, about one in five hundred cases; and why they occur in this particular one person out of five hundred we are at a loss to say.

The favorite localities where non-union occurs are, first, the middle of the humerus. That is very apt to fail of union if any bone does, then the femur, and then the tibia. Some bones never fail to unite; the collar-bone, for instance; the jaw almost never; and the radius, near the wrist, almost never fails to unite; but the humerus and the femur sometimes fail. Fanciful reasons have been given for it. I do not know whether there is any truth in them or not; but the position and the distribution of the nutrient artery of the bone have been supposed to have something to do with the want of vigorous repair in the long shaft of the humerus, or the femur. As I have said before, there is not any such thing as non-union. There is always some union, but union of such a soft and flexible character, that in the lower limb it makes a limb useless unless supported by a splint or crutches; and in the upper limb it gives an additional joint between the elbow and the shoulder.

We know that all fractures tend to shorten, some more than others; the oblique fractures more than the transverse,

and the long bones naturally more than some of the others, but all tend to shorten. We endeavor to estimate how much the shortening is by measuring. Measuring on the human body with the flesh and the various outlines to deceive us is a very uncertain sort of process ; and the only way in which we can approach accuracy is by taking three or four different measurements from different points, taking the mean result, and dividing the error, and estimating by that, just as we should in other mathematical experiments. It is a common thing to measure from the anterior superior spine of the ilium to the inner malleolus. We may measure from the anterior superior spine to the outer malleolus, and from the anterior superior spine to the top of the patella, that is, for fractured femur. A very valuable measurement is from the umbilicus to the internal malleolus. Some, or all of these measurements can be made, their variations divided, and a very close estimate to an accurate result got. I say a very close estimate; we never get it accurate. We never can tell, for example, that there may not have been originally some asymmetry of the limbs, so that one was one-eighth or one-fourth of an inch shorter than the other, from birth. Such asymmetry has been shown by Professor Humphrey and others to be very common; and a perfect man with absolutely symmetrical parts is very rare. Absolute measurements, therefore, to determine positively down to the fraction of an inch the amount of shortening in a fracture are impossible. We can get good approximate measurements, and, fortunately for the result to the patient, anything that is not beyond one-fourth of an inch does not make very much difference in the subsequent utility of the limb, or cause a limp; so that we are not reduced to these minute fractions except as a point of diagnosis; and more especially

as a point of diagnosis in trying to estimate the nature of an injury which a middle-aged or old person has received near the neck of the thigh-bone. Such fractures are very much to be judged of by the amount of shortening that occurs; and here the most accurate measurements possible are desirable.

When long bones are broken, the muscles will pull the ends apart and deform the limb. Even in this position, and in all positions, if they are given any chance at all, they will unite, and unite in the end by bone.

What measures of treatment should be adopted to promote good position and to promote union? They are very simple indeed. They are that the limb should be drawn down into place until the ends of the bones match each other and are opposite, and that after they are got there they should be kept in position and kept absolutely still; *apposition* and *immobility*, then, express the two cardinal points in the treatment of fractures. If you can get the ends into their natural places and hold them still a sufficient length of time, they will unite with a good limb: with the least amount of provisional callus, with the least amount of deformity, and with the most symmetrical looking limb.

Now the drawing down must be done by some mechanical force. Usually it is done by the hands of an assistant pulling the upper fragment in one direction, the hands of the surgeon pulling the lower fragment in the other direction. until the length of the limb is restored, and the parts look like the other side of the body. To keep it so, some sort of extension must be kept on, especially in the lower extremity; and that is now done by extending by a weight over a pulley, and a plaster bandage applied over the lower fragment up to the seat of the fracture. In addition to pulling down the part and holding the muscles in this way, we have to

contend with the muscles that immediately surround the bone, and must hold them quiet by some different means than the direct extension and counter-extension. This we do by pressing upon the parts themselves — paralyzing the muscles; preventing contraction by firm, direct pressure; by splints, properly padded, and called coaptation splints. The fact is they compress the muscles which surround the fracture, and keep them from slipping the fracture out of place.

Apposition of the broken parts, immobility secured long enough, coaptation, — those are the cardinal points in the treatment of fractures.

Now, perhaps, we had better take up another part of the subject, and enumerate very briefly the different sorts of fractures, describing what we mean by them.

Simple Fracture. — In the first place, the word simple fracture means a bone broken under the muscles and skin, having no access to the air, and being entirely a subcutaneous injury. This simple break is almost sure to have its effused inflammatory products around it absorbed without suppuration, and to be restored to its original state, so that repair of bone will take place without any chance of the formation of an abscess. You may perhaps think it surprising that it is almost sure to. Yet sometimes, even in the simple fractures, embolism, septicæmia, and formation of abscesses, do occur, in very feeble individuals, even where there has never been any communication with the external air; and, also, I may add, what I hope none of you will ever see, that I have seen in a severe condition of hospital gangrene prevailing in hospital wards, simple fracture rot the bone without any external break of the skin when the patient was brought in. That condition of foul sepsis we hope can

never visit us again so long as we practise antiseptic surgery. The fact that a simple fracture of the tibia, instead of healing in the ordinary way, should melt down in a foul slough, rot in the middle and lead to amputation, without any other injury, is a remarkable illustration of the virulence of the poisons, which, at that time, must have been floating about.

An aseptic fracture absorbs the inflammatory product, heals easily and never suppurates, because shut away from the external air. In the early days of subcutaneous surgery and tenotomy, when the practice was first introduced of cutting the tendons under the skin, no suppuration took place; and it was then found possible to inflict wounds without a chance of their failing of first intention; and subcutaneous surgery enabled surgeons to cut the tendons in cases of club-foot and other deformities with impunity, because done under the skin. A little knife was slipped in, the tendon divided; no air, no germs entered, and no suppuration took place. This was subcutaneous surgery. A similar condition of things takes place in simple fracture; and the reason why suppuration does take place in compound fractures, unless they are treated successfully by antiseptics, is the admission of the air, with the various floating spores of germs and low forms of life which it contains.

Compound Fracture. — Compound fracture means that the bone has broken through the skin and communicates with the air. It may have been pushed through; or the same blow which broke the bone may have cut the flesh and lacerated down to the bone. We may find a patient with a small hole through the skin over the tibia, and recognize by moving the limb that there is a fracture beneath. On investigating closely we find that the tibia is broken very obliquely, that a very sharp point projects upwards; and

that was the little point which pushed through the skin and has dropped back into place. We find a patient with a broken femur. On examination it may be found that the fracture is almost wholly transverse, no spiculæ, no sharp points, but leading down to the seat of the fracture is a sinus which goes from the outer air in. In this case the patient fell upon some external object, the bone itself never having been pushed out into the air. It makes no difference as regards prognosis. In either case air has been introduced; is still present in the wound. In either case we can often feel a little emphysema around the fracture; and in either case the fracture is what is called a compound fracture. Compound fracture as distinguished from a simple fracture, means a bone broken so that it communicates with the external air.

The word comminuted, when applied to fractures, means that the fragments are broken up into several pieces. It may be simple or compound. It may be broken up into fragments under the skin; or into fragments which communicate with the wound through the skin and with the external air.

Complicated Fracture is a term often used. It means, that, in addition to the break of the bone, there is an injury to some other structure, as a lacerated nerve, torn artery or vein, ruptured muscles, — something of that kind.

Transverse and **Oblique Fractures**, of course, speak for themselves.

Green-stick or **Partial Fracture** is another term which is quite descriptive. It can only occur in the bones of the young where the organic is in excess of the inorganic material, and the bone is flexible, not yet having become fully ossified. In that case, when violence is inflicted on it, it

bends and breaks partially, as the green twig bends and partially breaks. The bone preserves its bent form, and when the child with one of these partial fractures is seen, you will find a little roughness at the apex of the fracture, the bone bent down, almost a bow, and still not broken off.

It is almost inevitably the case that in setting such a fracture and drawing the part into place you complete the fracture. You find the same thing occurs in the twig. So that green-stick fractures which are severe enough to require treatment — some of them are not — will be pretty sure to be converted into complete ones by your handling. That is of no consequence; and it is much better to get the limb into shape and symmetrical than allow it to go with a partial fracture, and not corrected.

Some of these fractures are so slight as not to be worth the attention of being pushed back into place. This is especially true of the green-stick fracture of the clavicle. You find no break off, no crepitus. That collar-bone had better be left alone. It will settle down again. It is not much deformed, has not broken off. There will be for a while a lump or callus, which will be absorbed.

Complete and Impacted Fractures. — By complete fracture we mean a bone broken entirely across, free motion between the ends, and an additional joint in the limb.

By impacted fracture we mean that the shaft, or some portion of one of the bones, is driven into the cancellous tissue of the other end near an articulation; and this impaction is especially liable to occur in that fracture at the lower end of the radius, about three-fourths of an inch above the joint, known as "Colles's fracture," and at the neck of the femur in middle-aged and elderly people. These are impacted

fractures as distinguished from complete ones. Impacted fracture often cannot be diagnosticated; but may be suspected when an unnatural degree of lameness persists after an injury about the joint, where we cannot make out that there has been an absolute fracture — sometimes in the wrist, occasionally in the shoulder. In a few cases, autopsies made at this time, where the patients have happened to die of some other disease, have shown a radiating crack at the carpal end of the radius, where the scaphoid and semilunar bones may have been driven up against the radius in some violent fall. This fracture gives rise to long-continued lameness and pain, — a stellate fracture.

A most interesting class of fissures occur in the skull, because they are there of more importance, and may or may not mean a crack extending through both tables; and may possibly mean in some cases that the tough outer table has been merely cracked, while the brittle inner table has been splintered up into fragments on the inner side.

Occasionally, bones which have become united in very bad positions, are brought to the doctor to be re-fractured — broken over, and set straight. This is accompanied always with a good deal of force and difficulty in its accomplishment; it is sometimes very hard to do it. Occasionally the bone gives way in its sound part above the fracture, rather than break through the seat of a large osseous effusion and callus, which has mended the original injury. Moreover, if broken across through the original injury, they are much more slow to join again; and we have got to run a certain amount of risk of non-union, when we meddle with an old fracture of this kind. If the case is brought recently after the fracture, there can be no hesitation in doing this under ether, and expecting a good result; but,

as the weeks go by, the chances of accomplishing this become less and less; and after the normal period, so to speak, has long passed when bones join, as three or four weeks for the radius, six to eight for the femur, etc., and we are going into the second or third month, or later, after the injury, it becomes a serious question whether we are going to benefit the patient by attempting it. It is better, perhaps, in some cases that the patient should risk an excision, rather than a re-fracture and non-union. We cut down upon the part, saw out the deformed bits, match the parts nicely, wire them; and we are quite sure that we will get a strong limb. United fractures, broken over again, are slow to re-join.

How does the treatment of compound fractures differ from that of simple fractures? The old cardinal rule used to be: reduce the compound fracture to a simple fracture; make it imitate a simple fracture as closely as possible. In old times that was done by sawing off and smoothing any spiculæ of bone which might project, washing out the part, and putting it well down into place, and sealing up the small compound opening which leads down to the bone, either with a blood-clot and bandage, or compound tincture of benzoin; setting the limb, and trusting to time to reduce it to a simple fracture.

In these times we enlarge, if necessary, the wound; irrigate and wash out in the most thorough manner with some antiseptic solution; see that there are no broken fragments; get out the clots; give it an absolute cleanliness as far as possible; then replace it into its position, and do one of two things — either do it up simply with the wound left open and covered with antiseptic dressing, and the limb done up in plaster; or else, going a step further than that,

and having reduced the parts, smooth off the edges of the laceration and unite the skin by a continuous suture, sewing up the compound fracture, forcing it into a simple one, shutting it up with antiseptic dressing or plaster, and not opening it for three or four weeks, when it is expected to be healed.

The modern treatment is by far more successful than the old treatment. The old treatment, however, involved one or two principles which, I think, are nowadays sometimes neglected; for instance, the sawing off of ragged fragments very thoroughly before reducing the parts; sometimes making counter-openings and allowing drainage, or irrigations, in that way. Unquestionably, very many limbs were saved in that way that would otherwise have been lost; but we expected a certain amount of suppuration. We provided as far as possible against the chances of suppuration becoming a burrowing cellulitis by incisions, counter-openings, drainage or irrigation; but did not use the antiseptic method. The latter is the preferable method; and most cases of compound fracture are converted into simple ones, and get well. A curious problem sometimes presents itself to the surgeon — what to do with the fragments. Is it necessary to dissect them all out or not? Well, it seems not. It seems that those which have a good attachment to periosteum and muscles can be safely pushed down, and will consolidate and heal and agglutinate together, and that necrosis rarely occurs; but if detached, or small and rough or irritating, they had better be taken out.

Diagnosis of Fracture. — What are the signs that a bone is broken? They are usually stated to be three in number: that there is mobility, that there is deformity, and that there is what is called crepitus; and to this many add a fourth con-

dition, namely, loss of function, or inability to use the limb. The leg, for instance, is deformed and looks crooked. It is more movable and hinged than it is in the normal state. The ends of the broken bone may be rubbed together and produce a grating, which is called crepitus; the patient cannot stand or walk upon it, and this constitutes the disability.

Now, in the classical case, all these may be present. In the occasional case, some of these will be wanting. Deformity may be wanting in a fracture of the tibia where the fibula is unbroken. The fibula acts as a splint, and the tibia cannot get out of place, except that one fragment sinks back a little and the other rides up a little, and we can feel through the skin that there is a place where there is a notch; and that is the only deformity we can find. Deformity, where there are two bones and one broken, may be almost wanting. Mobility may be almost wanting, too. Crepitus cannot exist in an impacted fracture. That follows, of course. Consequently, crepitus is frequently wanting in Colles's fracture; and we may get rotation of the head of the radius in an impacted fracture, to a fair degree, because the fragments are wedged together — the bone twists, and they hold firmly.

Disability, impossibility of walking on the limb, is also not always present. In the fracture of the fibula alone the patient can walk. In the fracture of the neck of the thigh-bone in old people, where it is impacted, they frequently walk some little distance before they finally give up, and in some cases have been known to go up a flight of stairs. In ordinary cases we do get deformity and mobility, which last distinguishes fractures to a marked degree from dislocations, where the part is stiffer and less movable than in the normal state; and we generally get crepitus. If not at first,

we generally get it by moving the fragments a little; by rotating we frequently get the crepitus.

Some things may deceive us with regard to crepitus — a diseased condition of the neighboring tissues, especially the rheumatic joints of old people; what is called rheumatoid arthritis, where the articular surfaces are covered over with little protuberances which grate and rub. You will be surprised to find how this rubbing is transmitted along the bone, so that if you take a rheumatic joint and rotate it about, it feels as if the crepitus had gone down the whole length of the bone; and it may be absolutely impossible to distinguish, in case of a fracture, the rubbing here and the rubbing of the fracture itself. When a fracture is very near the joint, we may be deceived somewhat by it; or when the injury is very near the joint, we may be unable to tell whether it is fracture or not, on account of the slipping about and grating of the tendinous surfaces after the bruise. You can get quite a marked crepitus among the tendons of the shoulder and hip; and although after you have felt the real grating of the bone a few times, you can distinguish, yet, at first, it is not so easy. Dislocation is immovable and stiff. In it you have deformity; generally lengthening instead of shortening; you have immobility, instead of mobility, as in fracture.

VIII.

SPECIAL FRACTURES.

Fracture of the Nose. — Displacement in this fracture is usually only in one direction, and that is backwards and downwards.

The nose is made of two structures, partly bony and partly cartilaginous, supported by a centre-piece which is partly bony and partly cartilaginous. Where the cartilages are fastened on to the bone, occasionally separation takes place, and the nose drops, or becomes twisted on one side, that is, the cartilaginous portion of the nose. This, of course, is a separation and not a fracture. It is very difficult of correction. It is notoriously hard to make cartilage repair. It is also very difficult to make it readhere to bone with its original strength and in its former position; and the depression of cartilage separating it from the bone is much more unsatisfactory to treat than the injury of the bone itself.

An external splint moulded on with gutta-percha, or light plaster, with the cartilage pressed up in place is the best, and is about all, we can do. A steel pin has been occasionally passed through from side to side, pinning the cartilage up into place. This practically, I suppose, is harmless. The pin can be withdrawn after a few days, and is not likely to do anything more than make a slight ulceration.

The fractures of the bone itself are almost always driven down and inwards towards the nasal cavities. They unite

very promptly, so that any treatment to be of use must be early. Union takes place quite solidly within seven days.

Obviously the indication is to try to press the bone up into place from the inside. We are instructed to try to do this with the female catheter, or some instrument of that shape. A female catheter, however, is too large for insertion into the upper nasal fossa, and a director covered over with a piece of rubber tubing forms the best sort of lever to force the fragments out. With the aid of that, and the fingers on the outside, the bone can be easily moulded into place, and if it stays there, it speedily unites. Of course, after the pressure is withdrawn, the patient may have some slight coughing or sneezing, and be liable to throw the fragment out of place. Some have thought a support could be put inside the nose to hold the bone in place. A plug cannot be tolerated there long; and, if used, should be of some antiseptic material like gauze, and changed once in twelve to twenty-four hours, because it becomes very offensive. An internasal tubular splint of hard rubber, or gutta-percha, is also used.

The danger in doing too much to the fragment of so delicate a bone is, that if we press it and handle it too much, apply too much pressure inside and outside, we may lead to necrosis; and that, if we lead to necrosis, the piece of bone is eventually discharged into the nose. It is not replaced. It gives rise to a more disastrous deformity and gaping of the parts than if it had remained a little crooked. It is to be borne in mind that a good many of the fractures of the bones on account of the nearness to the surface are compound outside. They are almost invariably compound inside, as evidenced by the nose-bleed.

The trouble with the injuries that are compound outside

through the skin is that they may lead to abscess or necrosis, with a sinus. If a sinus exists afterwards, leading into the nasal passage, it is constantly kept open by the passing through of the air, and makes a disagreeable whistling sound, and is a serious deformity. Some slight plastic operation can be done to make the skin heal over the gap, but the bone itself cannot be restored. The pin can be used, just as it was in the cartilage, to hold the bone up in place. The splint of gutta-percha or plaster or wax moulded on from the outside is also, sometimes, very useful. If possible the parts should be thoroughly washed and irrigated with boracic solution (four per cent.), the bone gently pressed up into place from within the nostril; and if it will stay in place, and there is no external wound, the best treatment probably is to put nothing on it, but confine the patient to the house, for fear he may catch cold and be sneezing and coughing.

Any displacement can be corrected in the first five or six days. After that, union takes place in a false position. These injuries of the nose are not serious, but are a source of great anxiety to the patient, and a slight tip one way or the other is a lasting deformity.

Sometimes the septum of the cartilage, or a portion of the bone, or both, are so broken and displaced that, after they reunite, one of the nasal passages becomes narrowed and obstructed. This is a source of great trouble and annoyance, leading to uneasy, distressed breathing and the accumulation of mucus and deposition of secretions behind the obstruction, followed by a chronic ozæna, which is very offensive and difficult to cure. In those cases an operation should be done inside the nose. The septum may be drilled or partly cut off; the turbinated bones may be partially removed; and

some measure must be taken by which the calibre of that side of the nasal passage shall be approximately restored, in order to get the patient well.

Fracture of the Malar Bone. — The malar bone is sometimes broken by a direct blow, usually by a fall. The patient falls violently, perhaps, and happens to strike directly upon this buttress upon some sharp angle, like the edge of a step, or something of that kind. A blow coming exactly in the right direction upon this bone, which is very much exposed, is liable to break it. When it is displaced, it can be only displaced downwards and inwards. It may encroach on the temporal fossa and sometimes on the orbit. When it encroaches seriously on the temporal fossa, it interferes with the perfect play of the temporal muscles, leads to partial stiffness, fibrous anchylosis, etc. A more serious trouble, however, is when it is displaced so as to press into the orbit, in which case it sometimes protrudes the eye, destroys the exact axis of vision, leads to quite serious deformity, and, of course, a lasting deformity, unless it is relieved.

Now the majority of these cases of fracture of the malar bone are simple fractures. Most of them are very slightly displaced; and if they are so, if they do not encroach on the temporal fossa or upon the orbit seriously, it is questionable whether it is wise to do anything at all to try to restore the fragment to its normal position. Unless the depression is very great, the subsequent deformity will be but slight. If, on the other hand, the temporal fossa or orbital fossa is seriously encroached upon, then, although the fracture of the malar bone is simple, it demands some radical treatment to get the bone back into place. There is nothing we can get hold of. There is no way to get it back into place, except by making a compound opening and prying it up into posi-

tion. This can be done by making an opening below the malar bone, or by using a gimlet. This measure is practicable and proper in cases of marked depression; but in the simpler cases, without any compound opening and without any very great depression, it is probably as well to let the parts alone.[1]

When the fracture involves the external orbital plate, it is somewhat more conspicious, and therefore it can be easier manipulated and pressed up in place than where the bulk of the fat of the cheek lies over and around the bone.

Fracture of the Upper Jaw. — Fractures of the upper jaw occur usually in consequence of direct blows with timbers, or bricks, or stones, or from a railroad accident. They are always compound into the mouth and nose. They may also be compound through the skin, and they may not. The position of displacement is always downwards and backwards; inasmuch as the blow is received somewhere upon the upper jaw, it gives way usually across the nasal process and just below the antrum, below the zygoma, and this fragment is driven back and down into the nose and throat. Occasionally double fracture occurs, that is, a blow is received in such a way that the arch is broken entirely across below the malar bone, depressing both superior maxillary bones backwards towards the nose and throat.

Double fracture of the upper jaw is an extremely serious injury, and in about sixteen per cent. of the cases, or perhaps more, is followed by a fatal result. Single fracture of the upper jaw is almost always recovered from. The reasons of the fatality are hæmorrhage, erysipelas, which is very apt to supervene, and septic absorption, which is also quite apt to

[1] The malar bone has recently been pried out into place, from within the mouth

occur on account of the numerous spaces which are open and broken into, and the collection of foul secretions which may take place, and thence their absorption from lymphatics or veins followed by septic symptoms. Abscess, with caries and necrosis, is also a quite common sequence.

Now, the superior maxillary bone is a very light bone. It is built out into certain strong bridges where it holds the teeth, where it joins the nose; but it contains the antrum. It is a porous open bone; it contains a very delicate process called the palate process, which extends back over the upper part of the mouth. When it is broken, it is very apt to be chipped into a good many fragments, so it is almost always a comminuted fracture of the more delicate part of the bone.

Intimately attached to, and lined, as it is everywhere with, mucous membrane, very many of these comminuted fissures and breaks become compound and bleed largely from the mucous membrane, and are also somewhat difficult of repair and replacement. The teeth also are liable to become loosened and displaced. It is rather a wise caution not to attempt to draw any tooth which is at all firm in this fracture, inasmuch as we usually render the fracture a great deal more complete and disastrous in the effort to extract the tooth. The teeth should be carefully pressed back into the sockets, and we should make an endeavor to restore the parts to place.

Another important point is this, that no fragment which appears to be quite loose and comminuted should be removed. A mosaic almost of fragments of the upper jaw will reunite and form a very respectable roof of bone, because these bones are very thin, and so intimately connected with the mucous membrane and the vessels on both sides that it is difficult to destroy their vitality. If we pick away the fragments, we

shall usually break the mosaic, and make a deformity which is not necessary.

Do not try to draw teeth which are firm. Do not pick away loose fragments.

How shall the jaw be retained in place? Fortunately, we have in the lower jaw the natural splint to adjust the part. Bandage that firmly against the upper. Where there is a large lacerated wound across the front of the lip and below the nose, leading down to the fractured surface, then we have a very good opportunity, if necessary, to drill and wire at some point, and hold the bone very firm; but unless there is a compound opening, it is not always wise to make a wound, and usually the splint of the lower jaw will prove sufficient. This is certainly true of fracture of one superior maxillary bone. In fracture of both superior maxillary bones, it may be necessary to wire the parts.

In these cases an enormous amount of tumefaction and distress occurs. The patient is constantly choking and gurgling, and endeavors to expectorate, swallows secretions, loses a good deal of blood, collects a great deal of foul matter as the days go on, and is nourished with difficulty. They are hard cases to nurse and take care of. They must be fed with great care. They can be fed sometimes by means of a teaspoon, sometimes by means of a tube or soft catheter through the nose, whereby the fluid can flow down through the pharynx to the stomach.

The external parts of the face must be carefully watched, and every source of irritation removed. Tight bandaging is to be avoided on account of the chance of œdema terminating in abscess, or an erysipelatous inflammation being set up.

The single fractures usually do well. The double fractures are usually serious.

Only extreme violence can give rise to this injury. In ordinary blows received from the fist, the upper jaw rarely gets the force of the blow. It is more apt to light upon the lower jaw or the malar bone. The upper jaw is almost invariably broken by accidents received from steam power, from rapid locomotion or from a fall from buildings, falling from a height—something of that kind.

Fracture of the Lower Jaw.—The lower jaw is much more frequently broken than the upper. It usually gives way at the symphysis. The next place of weakness in breaking is opposite the inferior dental foramen. That would bring the line of break down between the bicuspid teeth. That is a favorite place. The symphysis first; then a point opposite the mental foramen; and, lastly, the ramus or the junction of the ramus and body.

It must be obvious that the easiest case to treat is fracture at the symphysis. But little displacement takes place, also, because a double set of muscles attached into either half of the bone are pulling equally, and there is not much to draw the fragments out of place.

If the teeth remain sound, a wire can be passed across them and twisted; and usually that is sufficient to restore the contour of the parts.

The fracture through the mental foramen is liable to a good deal more of displacement, because we have attached to one of the fragments all the hyoid group of muscles, and to the other fragment the pulling action of the masseters and the rotating action of the pterygoids.

When we come to the junction of the ramus and body, the case is a great deal worse; and the action of the external pterygoid muscle, which pulls across, is such as to twist the ramus far away from the contact with the body of the bone.

Fracture of the symphysis easy to treat; fracture at the mental foramen moderately hard; fracture at the ramus extremely hard to avoid deformity.

All these fractures are compound in the mouth. They break through the gum, through the alveolus, communicate with the mouth, do not necessarily communicate through the skin with the external air. They are compound in rather a worse place than if outside, because it is very difficult to keep the parts clean.

Crepitus can be got. Deformity is always present to a certain degree; and, if it is not marked, it may be recognized by looking carefully at the line of teeth, and seeing whether they match, closing the jaw against the upper jaw, and seeing whether the natural lines of divisions between the teeth are central, or whether those on the lower jaw are drawn a little to one side of the true line. Then, by lateral deformity judged in that way, or vertical deformity, we can always recognize the presence of displacement and fracture, and on moving the jaw we can get crepitus; so that I should say it would be difficult to overlook a fracture of the lower jaw provided any one made even a very moderate examination.

It is easily diagnosticated. Unfortunately, it is not so easily treated. Its powers of repair are very great; and the lower jaw unites (with none, or but slight, provisional callus) in fourteen to twenty-one days; most of them in fifteen to sixteen days, quite firmly, in spite of the compound connection into the mouth.

The disasters that may follow this injury are quite numerous: displacement, loss of teeth, imperfect restoration of the line of the jaw, so that the patient never afterwards can make the teeth meet evenly, so that they meet on one side

of the mouth, and do not meet but leave a gap between the teeth, on the other side. Abscess, caries and necrosis are quite common sequences of fracture of the lower jaw.

Rarely we find fracture of the lower jaw double; that is, we find two breaks, usually on the same side, but a separate fragment of the bone broken in two places.

We must be very much on our guard in treating these cases to be sure that a displaced tooth has not got dropped in and lodged between the fragments. This has occurred and been overlooked many times, and is an efficient prevention of any union, the tooth lying as a foreign body, preventing apposition and union, and provoking caries of the jaw and discharge of the tooth. You must count the teeth and look around carefully to see if the fragments are clean and no foreign substances lodged between, and press them in place and hold them there. If the patient has a good set of teeth, we can wire across with a silver wire, and draw the bone pretty thoroughly together. This, with the aid of setting the jaw against the upper jaw, and bandaging from the outside, is sometimes sufficient. A more efficient mode is to take a cast of the lower jaw and teeth with hot gutta-percha, which will set firmly in place. In that way there may be constructed what is called the interdental splint, which fits over all the teeth, and, if accurately applied and allowed to cool while the jaw is held in place, is a perfect splint. In addition to this, it is easy to mould a piece of gutta-percha on the outside to make an external splint, and between these two, with a bandage, the fragments can be held in place.

Some have gone farther, and drilled and wired together the two splints, the internal and external splint of gutta-percha, so that the parts should be held together. That, however, usually is not necessary. It is difficult to feed the

patient with this splint on. They must be fed with a tube through the corner of the mouth or through the nose. We have the consolation of knowing that, if we can hold the parts in place for a fortnight, we are pretty sure of union, and the confinement of the patient need not be so very long.

There do occur cases where it is impossible to hold the fragments together. Then, rather than that the patient should grow up with a crooked and misplaced jaw, and the chance of non-union, it is wiser to make a compound opening on the outside, to scrape bare the bone on each side of the fracture for a little space, drill and wire, and draw the bone firmly in contact. This leads to perfect and bony union. It is followed by slight caries around the site of the wire-holes, and after union has taken place, and we desire to remove the wires, they will invariably be found loose, the bone will have given way through the hole that has been drilled, the wire will be playing backward and forward although the twist is still on it. There is practically no difficulty in pushing back the granulations and untwisting and drawing out the wire after union has taken place. About four weeks should be allowed for this. I have had some experience in wiring the jaw, after making sections of it for various operations, and I have invariably found good union to result at the end of about four weeks. Then you find the wires loose, and easily withdraw them, and healing of the wire-holes usually is not very long delayed.

Mild cases can be treated by wiring the teeth. More severe cases with the interdental splint and external splint. Severe cases, if necessary, by wiring the bone itself, but that is rarely necessary. Bandages holding the lower jaw firmly in contact with the upper are indispensable, and the patient must be fed, and the parts kept as clean as possible.

It is surprising, in a foul cavity like the mouth, how rapidly and safely repair takes place in many cases without the occurrence of any septic consequences that are at all serious.

Fracture of the Hyoid Bone. — Once in a while the hyoid bone gets broken. It can hardly be broken unless in a violent struggle, when it is broken by the hand in clutching the throat, or something of that kind.

The patient feels a good deal of pain and distress in swallowing: the hyoid bone giving attachment to so many of the muscles which move the jaw and throat, that the resulting distress is a good deal.

It cannot be held in place perhaps, but it can be replaced with the finger in the mouth far down in the throat and the hand manipulating outside; and that is the best that can be done.

It is not a serious injury.

Fracture of the Thyroid Cartilages of the Larynx. — Fracture of the thyroid cartilages of the larynx is produced in the same way by violence directly inflicted, usually by the hand, occasionally by the patient being run over by some light vehicle, by a light wagon, for instance, which passes across the neck and breaks and depresses one of the thyroid cartilages.

This injury is usually not compound; and it is to be diagnosticated by taking hold of the larynx and rubbing it from side to side, and feeling the mobility of one part as compared with the other, by a sort of click and rubbing like a crepitus, and a rapid occurrence in the larynx of œdema and hoarseness. It may lead to such œdema of the glottis as occasionally to destroy life. If, then, there is an undoubted fracture of the larynx with hoarseness coming on, it is some-

times wiser to do a preliminary tracheotomy and retain the trachea tube a few days, while repair can take place. If the displacement is not easily held in place, it is proper to make an incision, drill and wire the two thyroid cartilages, and treat it as a fractured bone with a wire passed through it. This will hold it in place. Union will occur. The trachea tube avoids the danger of suffocation by œdema of the glottis.

Unfortunately, it is not so safe and successful to wire cartilages as it is to wire bone. Cartilage does not tolerate that sort of interference so well. Cartilage is a poorly nourished structure, ulcerates easily, and very frequently the wires that are passed through give rise to slight suppuration and some ulceration of the parts. They should not, therefore, be left in too long. They should be carefully watched, and in a fortnight withdrawn, union having taken place.

I perhaps should have said a word more about fracture of the lower jaw at the ramus. This is excessively difficult to treat, and unless we cut down upon the parts, and wire the fragments together, it is practically impossible ever to get them into perfect contact.

This cutting down and wiring the parts here is a much more serious operation than doing it elsewhere. We have got to go through important muscles, and the parotid gland and its vessels, and there is a good deal more chance of abscess than in front. Consequently, wiring of the ramus is not to be adopted except in the extreme case.

What happens if the parts do not get in perfect contact? Practically, that there is overriding and displacement; there is almost invariably union. The displacement is due to the twist of the pterygoids, the other fragment being drawn violently upwards and backwards by the action of the masseter muscle. The temporal pulls the upper fragment

out of reach, the external pterygoid twists it into the mouth, and meanwhile, the lower fragment is drawn backwards and upwards by the masseter.

Fracture of the Sternum. — The sternum is usually described as being made up of three pieces: manubrium or handle, a body, and a xiphoid or ensiform cartilage. The junction of the upper piece, manubrium, and the body is always opposite the insertion of the second rib; the second rib is inserted into this notch. Many cases which are considered fracture of the sternum are separation at that joint. That is the place where the injury usually occurs, opposite the second rib. Extreme violence may fracture it across the body, in the middle, of course. Separation and bending of the xiphoid cartilage may occur in consequence of a violent and peculiar blow received on it, either by the fist or falling on some hard substance, and occurs at the junction of the lower piece with the body.

Now, fractures of the sternum are rare, fortunately. They occur in consequence of the caving-in of a bank of earth; once in a while in wrestling and struggling by the pressure of the weight of the knee on the breast-bone; occasionally by contre-coup. Such an instance occurred to me once, where the patient was frescoing the top of a church and lying in a sling. The rope gave way; he fell and broke the scapula and some of the ribs, and broke the sternum by the transmitted force, apparently.

In very feeble old people it is well known that a sort of fatty degeneration of the bones of the thorax takes place, and spontaneous fracture of a rib from coughing is occasionally an actual occurrence; so also, it is said, that sometimes the sternum has been broken in a violent fit of coughing; but at the best the accident is rare.

The displacement is of the lower fragment backwards and inwards, with the upper fragment overriding it, as a rule. The bone is so superficial that the deformity can be traced as a marked line. The bone rides up into place with a snap which gives crepitus when the patient breathes, and then drops down again.

The consequences of the accident are described as sometimes serious. I have never seen any serious consequence myself, but one can conceive of it. The mediastinum and pericardium are in direct relation with the sternum: and inflammation may be set up inside and behind the bone, resulting either in mediastinal abscess, pericarditis, or limited pleurisy.

The diagnosis is not difficult.

The treatment is difficult; for it is hard to see how we can get hold of this bone and spring it back into place. Usually the patient sets the bone himself, and if he is laid on the back with the shoulders thrown back and arms held, and encouraged to make two or three strong inspiratory efforts, he generally brings the broken fragment up into place. When this does not occur and the depression is considerable, it is important to bring it back into place; and this can be done with comparative safety by making a small opening over the fragment, putting in a gimlet or drill and pulling the bone up into place, and closing the wound and letting it heal.

The only fracture of the sternum so called, which gives rise to severe and immediate symptoms, is the separation of the ensiform or xiphoid cartilage below, which occasionally gets bent-in in such a way as to compress the diaphragm, and give rise to very painful spasm and distress in breathing, pressure on the solar plexus, etc.

In that case we are hastily to cut down and pull the bone back into place, if necessary.

I do not know that any particular treatment would be of use in the subsequent care of the fractured sternum except to apply perhaps a light thoracic belt, which can be laced around the body, the patient forced to lie in bed a week or ten days, kept quiet on the back, and kept from turning or moving. Opiates probably would be a great addition to prevent the chance of sneezing or coughing or rapid breathing.

Union takes place promptly; and I believe such a thing as non-union is practically unknown.

Fracture of the Clavicle. — The collar-bone is very frequently broken. It is a buttress, holds the arm off. It is the only thing that connects the arm by bone with the thorax.

Blows received on the shoulder are transmitted along the collar-bone and are liable to break it; so that a fall on the shoulder in a young child is almost always followed by fractured clavicle; and a direct blow on the clavicle is a ready means of breaking it, because it is so exposed. It is, however, a very strong bone. If you ever had occasion to saw it, you know how strong it is. It possesses great power of repair. It will mend without treatment; it will mend rapidly with treatment; and union takes place in from one to three weeks. It will mend in little children and babes without any treatment at all, not always without displacement and deformity, however. Usually where the bone is broken near its middle, the full width of the shoulder as compared with the other side is not perfectly restored. The patient is always a little more narrow on this side than on the other. Those whom I have questioned, and the common opinion seems to be also, that the

strong and laboring man who uses his arm with vigor after the break is solid has as much strength as ever, and does not miss the quarter-inch or more of loss of width.

Now the collar-bone is tied down at the two ends by a strong ligament, here to the first rib and there to the coracoid process. Fractures which take place at either end, within the fibres of these ligaments, are not accompanied by displacement; no deformity is produced. Crepitus can only be elicited by taking the arm and manipulating it around so as to move the centre of the collar-bone.

Obviously no treatment is required in such case except to keep the parts still. They cannot be much displaced, but you do not want them turned about by the motions of the arm; so you put the arm in a sling, and perhaps a light bandage on, and hold it still. The fragments are held in place, and union promptly occurs.

In little children with broken collar-bone without treatment, union will take place in ten days, as a rule; and in babies it takes place in a week. In the adult it takes about three weeks.

When we come to the junction of the outer third with the inner two-thirds, that is the favorite seat of fracture; and there the majority of the cases of break occur. Displacement there is extreme. The weight of the shoulder pulls the outer end down, so that it droops down and in towards the thorax; meanwhile the attachment of the sterno-mastoid pulls the other fragment up, and they are always shot by each other to a very marked degree. Meanwhile, the position of the patient is quite characteristic and peculiar. The shoulder droops, drops in so that it is less wide; and the patient instinctively supports his arm and elbow to give freedom from the pain.

The obvious indications of treatment are to try to get the parts together into their natural position by raising the shoulder, pressing it upwards and drawing the elbow back, putting a pad in the axilla, forcing it backwards and upwards, and having the elbow well confined to hold the parts in place. Without apparatus the bone can be restored to place, and will stay there if the patient is put in a certain position. That position is lying directly on the back without much of a pillow, the shoulders flat on the bed, the elbow bent, and the arm fastened to the side. In that way the fragment will fall into very good position and stay there without apparatus, as long as the patient avoids lifting the head, or turning. In this way most of the deformity from this injury can be avoided; but in all ordinary cases of fracture of the collar-bone at this point the subsequent deformity is something, and a perfect outline of the collar-bone after a fracture there is almost unknown; so that the patient should be made to understand that the shoulder will be a little narrower, that there will be a slight bunch at the seat of the fracture, but that the arm will be as useful and strong as ever.

In the case of young females, where it is very desirable that the perfect contour of the neck shall be restored, if they will submit to a fortnight's confinement on the back, it will give a better result than anything else, and diminish the amount of subsequent bunching up and deformity in the outline of the neck.

This fracture in children unites in all sorts of ways, with and without treatment. They always have deformity, a bunch; but, as a rule, as the child grows up this callus diminishes, rounds off, absorbs, disappears, and the child shows very little deformity after it reaches adult life. Not

so the fractures that occur in people who have passed the age of fifteen or sixteen years. In them the deformity is permanent.

Cases occur, rarely, in which disastrous results are said to have followed the occurrence of great deformity from there being set up about the part a tendency to form osteophytes upon the under surface, which press upon the vein, and give rise to subsequent pain, œdema and paralysis. Such cases are not very common, but they have occurred; and it is well to remember them in order that, if such a case should occur, we could assure the patient it could not be the fault of the physician, but one of those vagaries of nature that we have no means of controlling.

In little children fracture of the collar-bone can be perfectly treated by merely confining the arm to the side. In the baby the body and arm can very well be sewed up in a pillow case. In the older child the double bandage can be applied; but when we come to the period of twelve or fifteen or beyond, where deformity and overlapping is considerable, we have got to put on a more complicated apparatus, if the patient is going to walk about. The axillary pad is very important to lift the shoulder and to restore the width; then draw back the collar-bone, push back the arm and hold the elbow back towards the loins.

This is accomplished in a great many ways. Fox's apparatus is perhaps as comfortable as any. Dr. Sayre introduced a treatment by strips of plaster. The Velpeau bandage sometimes does pretty well. Strapping the elbow back is an important assistance. Nothing can be done, so far as I have observed, by pressure on the collar-bone itself. You do not want any pressure on the outer fragment, you want to keep that up; and the only way you could overcome the

tendency to displacement of the inner fragment would be to divide the clavicular belly of the sterno-mastoid muscle. That is not to be thought of except in extreme cases where no other means would avail.

This bone generally breaks at the junction of its outer third and its middle third. The fragments always overlap. The inner fragment rides upwards and backwards. The shoulder droops. The width of the shoulder is permanently diminished afterwards. Union takes place promptly; always with deformity. The amount of deformity may be regulated a good deal by care, by apparatus, by the amount of confinement that the patient will endure. The subsequent utility of the arm is about as good as ever. If the fracture occurs at a young age, deformity will be smoothed off and melt away. If it occurs at an older age, it is permanent.

Fracture of the Scapula. — The scapula may be broken across the infraspinous fossa, may be broken at the acromion process (that is a very common place), may be broken rarely at the coracoid process; and, it is said, may be occasionally broken at the neck, by the neck meaning the constricted part, behind the glenoid cavity where the head of the humerus rests.

The common fracture is across the lower part of the bone, usually inflicted by direct violence, as a blow or fall upon the back; generally it is broken in an oblique direction, and the deformity is considerable on account of the varied attachment of the scapular muscles. Strap with plaster, and confine the arm to the side, about four weeks. Fracture of the acromion is treated by raising the elbow and forearm, and confining the arm to the side.

The coracoid process is the next in order of frequency.

If you remember the extreme strength and the various attachments of the ligaments which fasten the collar-bone and the acromion and the coracoid, and which are inelastic, firm masses of fibres, you see when the coracoid process gets accidentally broken there can be but very little displacement. The ligaments would probably resist more violence than the bone itself. As a rule, the reason why a fracture of the coracoid process is notoriously rather hard to detect is the fact that it is not drawn much out of place, and is so situated that it cannot very well make any deformity. You do not see anything of the broken coracoid until you hunt for it and find it, except possibly a bruise. You examine over the tops of the two shoulders and try every manipulation of the arm, and test for every point, as the collar-bone, acromion, humerus, etc., and still you are conscious that there is a crepitus somewhere, but you cannot locate it; and finally you find it in the coracoid process; and once having found it, you can reduce it quite readily. It being not much displaced, there is not much setting of the bone to be done.

The only treatment is to prevent motion. The muscles which are attached are the pectoralis minor and the coraco-brachialis. To put a pad in the axilla would be poor treatment, for it would press up the fibres of the coraco-brachialis and probably displace the fragments. In order to relax the parts as much as possible, put it into the Velpeau position or bandage, in which the hand is put on the opposite shoulder.

It is a long treatment — four to six weeks. It is slow to join. If it is not recognized and treated, it remains ununited and gives rise to constant grinding, neuralgic pain and troubles resembling rheumatic arthritis, for a long while afterwards. This is a fracture which is occasionally overlooked, and that is the result.

The diagnosis once made, you have a reason to give why the treatment should be long and exacting; and then the patient must begin to exercise the pectoralis muscle and the coraco-brachialis with a good deal of caution, for some time to come.

Now the remaining fracture of the scapula is so rare that some authors deny its existence; and it depends a good deal, I think, upon how we consider it, whether we can admit it. If we mean by a fracture here of the glenoid cavity simply a stellate series of cracks, I have no doubt they occasionally occur. Experience and sections have proved that they occur also at the end of the radius; a violent fall upon the end occasionally forcing the bone to give way where its weak part is, drives these bones of the carpus up against the radius and chips it and cracks it. The same thing occurs undoubtedly in the glenoid cavity; and that is an injury without any visible displacement, and with no symptoms except lameness. Given a lame shoulder, where you can detect no deformity and no displacement, where there is some obstinate fact behind which seems to prevent its moving with ease, or getting well, then you may suspect a crack of the socket. That, I have no doubt, occurs, especially in old people. But the other, true fracture of the neck, it seems almost impossible should occur. What is to break that off except the extreme violence of a lacerated compound fracture, or something of that kind? By the ordinary injury this must be very hard to detach. In the first place, it is a solid bone, no epiphysis; it is extremely thick and well protected. If a fracture exists, it is excessively rare and could be diagnosticated only from the fact that the shoulder would drop, and when replaced would drop again, because the socket itself would drop with it.

The treatment would be just the same as to reduce a dislocation, and to reduce fracture of the anatomical neck.

Stellate fracture is not very uncommon. Fracture of the infra-spinous fossa is the common thing. Separation of the acromion is the next. Fracture of the coracoid process is rare, and true fracture of the neck is almost unheard of. All fractures of the scapula, then, are easily treated. The one that requires the longest time, of the ordinary ones, is fracture of the coracoid process.

Fracture of the Ribs. — Nature has protected the upper ribs so much that they are very rarely broken, especially the first rib. Fracture of this rib is extremely rare; and, as you see, it can hardly be got at unless the collar-bone is broken first, and even then it must be a very peculiar force to reach it.

The second rib, again, is very thoroughly and largely covered in by the pectoralis muscles. So is the third; the fourth, fifth, sixth and seventh are those most exposed to fracture, first, because they are more superficial, and second, because they are pretty firmly attached at both ends, whereas the lower two or three ribs, which are loosely attached to the sternum, the eighth and ninth, and the eleventh and twelfth, which are floating, are much more likely to yield to a blow without cracking; so the fourth, fifth, sixth, seventh and perhaps, eighth, are the common ribs that are broken.

Then as to place, they are usually broken about one-half way between the angle and the sternum, on the side of the thorax; that is the usual place. It is rare that two ribs are broken; one rib usually. It must be by a fall on some singularly well-arranged point to break two ribs — a peculiar fall on the corner of a step, or on the edge of a curb-stone.

Ribs are quite frequently broken by the shafts of passing vehicles when persons are struck or run over. That is quite

a common cause. A blow by the fist is a rare cause, however. Once in a while in a feeble old person — I have known one or two cases — a rib has been broken by coughing. In the healthy person, however, the rib resists a good deal, and has to have a sharp, peculiar blow to break it. It is not likely to be broken where it floats, and therefore it is the fourth, fifth, sixth and seventh that usually gives way.

Fractured rib in the female under the mamma, or in the fat male, is hard to get at, hard to detect. In the average person, who is not stout, the ribs can be thrown out into sight pretty well by getting the patient to lean over or getting the arm up, then by inspiration you can diagnosticate the fracture easily; but under the large mamma it is sometimes quite difficult.

The most marked and peculiar symptom is an acute, fixed, stabbing pain on inspiration which is very strictly located in one little point. Thousands of people fall and bruise themselves and have pain in the side, and think they have broken ribs. You may think so also. You investigate to see, and you find that they cannot locate the pain in any spot smaller than the palm of the hand. It hurts here and there and all around, an area as large as the palm of the hand. You must not either be deceived by a strictly localized pain; because certain acute diseases give rise to very acute pain about the rib. And if in any case you are in great doubt, it is wiser to look at the surface of the skin to see if that is healthy, or whether that is the seat of any trouble which may give rise to the pain. A female may have a slight blow, apparently not violent enough to break a rib, but followed by intolerable pain. Such cases will be found occasionally to be due to the earlier stages of herpes zoster, which is intensely painful; and if you can find three or four of these vesicles begin-

ning to break out, the next day you will see plenty, going round from the sternum to the vertebræ: and the diagnosis is established. Of course, that is not very often a cause of deception, but it may be. I would urge upon you in examining for broken ribs to see the naked skin, if possible. Make the patient locate the pain; put the finger on it, and see if they can bring it down to a point within an inch. If they can, then you become very suspicious.

Now we diaguosticate broken ribs in the most accurate way by feeling crepitus, but the crepitus is very slight, more slight than that of most other fractures; and with firm pressure upon the chest with the hand you often fail to detect it. Having located what you consider the doubtful point, it is best to make very light pressure with one or two fingers, and then if you can induce the patient to cough, that often will give you the characteristic snap under the finger, which once heard is enough. The stethoscope is sometimes used, and may enable you to hear crepitus. A perfectly localized, stabbing, fixed pain, produced by inspiration; the history of an injury; crepitus, of course, if you can get it. Other symptoms come on later which are very marked; such, for instance, as a slight attack of pleurisy, cough and, particularly, emphysema; if you have a little bubbling of air under the skin, with no wound of the skin, you surely have got a fracture of the rib, nothing else.

Broken ribs, if untreated, will finally unite of themselves; but remain a long while loose and uncomfortable. If treated, they unite promptly, generally in about three weeks, certainly in four, without much callus and without much deformity. The patient is more comfortable, if allowed to sit up. There is no particular reason to keep him constantly lying down. Inasmuch as the sitting up in bed is a very

tiresome performance, it is best to let him have a large chair, and sit in some quiet spot where he can adjust himself. Strict orders, however, must be given that the patient with fractured rib must not be allowed to go out of doors, because in the simplest case we have the great risk of pleurisy ensuing; and pleurisy, of course, means acute pleurisy followed by cough, rapid breathing, shaking up of the fracture, delaying the union, possibly a serious effusion terminating in a purulent one, so that we may have no end of troubles arising from this simple cause. A patient may be allowed a good deal of latitude and liberty in a warm room, but should not be allowed to go out of doors.

Treatment consists in holding the ribs still by compressing the thorax with strips of plaster. If but one rib is broken sometimes it is sufficient to encircle one-half of the thorax with plaster. If there is a fracture of several ribs, or if it is not held still and easy, it is best to put the plaster all the way around, and girdle him with strips high up on the neck and down to the ensiform cartilage. Hold the thorax still and let the patient breathe with the diaphragm, and the comfort afforded by this treatment is immense. He ceases to feel the pain, ceases to hear the clicking of the broken rib, he can turn over with an ease he could not do before. The rubber adhesive plaster, spread on very strong cloth, is the best; and may be cut in strips about an inch and a half wide and of a length to encircle the chest; or to reach only from the sternum to the vertebræ; and strip after strip should be put on, pretty tightly.

Now comes another point, which is quite important. If you are going to keep the rib perfectly still, you have got to immobilize the arm; otherwise you defeat your object. The scapular and pectoral muscles and the latissimus dorsi all are

attached to the arm; and any motion of them is pulling on some portion of the broken rib; consequently the rib must be bound with plaster, then the arm must be firmly confined to the side by a bandage and by a sling over the shoulder, the patient being kept exactly in this position. Thus being kept perfectly still, he can get up or sit down with freedom and more comfort than to be kept lying on the back.

Emphysema, as a rule, does not require any treatment. If excessive, it may be punctured, though the relief afforded is questionable. It absorbs generally with rapidity. We are speaking now of simple fracture of the rib. Compound fracture of the rib, of course, would require more radical treatment in the way of washing out the cavity, taking out fragments of bone, etc. Simple fracture of the rib is a very common accident, and happens especially to middle-aged and elderly people. Naturally in advanced age, the ribs, which are never very strong bones, become more brittle, and are quite apt to be broken.

Almost all cases, if treated judiciously, make a good recovery. One can conceive of a fractured rib in an old person injudiciously treated; as, if one insisted on keeping him flat on his back, and keeping him absolutely still, one can conceive that the slight irritation of the pleura, the hypostatic congestion, etc., would easily bring on a pneumonia, which in old people is rapidly fatal.

Make a diagnosis with gentleness; secure the parts with firmness; keep the patient warm, and in one atmosphere; and that is all.

IX.

SPECIAL FRACTURES.

The humerus has a great variety of fractures. The anatomical neck, so called, which is the part near where the capsule is attached and above the tuberosities, and which really is hardly a neck at all, as you see is occasionally separated. This fracture is usually a fracture of advanced age, and corresponds very much to the fracture of the neck of the thigh-bone in old people. Like that, also, it is occasionally impacted, so that the shaft is driven up into the head, but more frequently it is a complete fracture.

Going down the bone a little way, we find the line of the epiphysis, which includes the tuberosities, that is to say, it is below the tuberosities. The tuberosities and the anatomical neck and the head are above the epiphysis. The epiphysis unites very late. In this skeleton the line of the epiphysis is very sharp still; and it is quite natural that frequently that should give way in the fracture, so called, of the neck of the humerus. Separation of the epiphysis is practically about the same thing as a fracture of the surgical neck, that is to say, it takes place within a fraction of an inch of the same locality; and whether or not the epiphysis will give way, or the surgical neck will give way, depends on the age of the patient. In young subjects, the epiphysis separates; in older subjects, the neck breaks. Then these two are combined usually under the ordinary name of fracture of the surgical neck. These two things are the great distinctions

then; fracture of the anatomical neck, fracture of the surgical neck. By fracture of the anatomical neck, we mean the line of insertion of the capsule, and above the tuberosities; by fracture of the surgical neck, we mean the neck of the bone where the shaft comes up to join the head, and below the tuberosities; and if it is a very young subject, it will probably be a separation of the epiphysis. We find also this marked distinction, which I think it is well always to bear in mind: and that is the influence on the location of the injury of the age of the patient, — a young person, fracture of the surgical neck; an old person, fracture of the anatomical neck.

Going down the shaft of the bone, you may have fracture anywhere about the shaft of the bone. When we come towards the lower end, we find the bone growing very thin, broadening out into the two condyles, and there at the points opposite the olecranon and coronoid processes being extremely thin, and in some races, and in occasional specimens in our own, being perforated there. That weakens the bone a good deal. Fracture, then, across the shaft, just above the condyles, is quite common. That differs from ordinary fracture of the shaft, because it is close down to the line of the articulation. The bone gives way through this thin part, and breaks, usually obliquely; and it is called transverse fracture of the shaft of the humerus above the condyles. It is this fracture which imitates, and is so often mistaken for, dislocation of the forearm backwards.

When we come to the very end of the bone, we have condyles and epicondyles; epicondyles being little minute condyles themselves. The inner is that part of the internal condyle which is external to the joint; the external epicondyle is the ridge which runs down with the insertions of the

extensor muscles, and is outside the articulation of the bone with the radius.

The internal one is commonly chipped off in the falls of childhood. They separate as an epiphysis frequently. They do not go into the joint, nothing to do with the joint. They are not very important injuries, and the epicondyles themselves speedily unite again, and ought not to give any deformity in the way of stiffness of the elbow-joint. But when we come to the true condyles, which include the articulating surfaces, a fracture of the inner condyle necessarily comes down through the surface that articulates with the ulna; and when it is broken off and displaced and drawn aside by the muscles, it necessarily carries the head of the ulna with it, and makes a very marked deformity. That is true fracture of the internal condyle. When it breaks and is drawn aside, the olecranon is dislocated with it, and the joint thrown out of place. When union takes place, it is likely to take place with a certain amount of roughness at the seat of the fracture. The perfect smoothness and polish of the joint may be restored; but a stiff elbow is more or less probable, according to the age of the patient. It is not necessary to have it, as a rule, until the age of puberty; but after the age of puberty, it is almost always present to some degree. So, also, fracture of the external condyle, which goes through the part of the humerus which articulates with the radius, — necessarily carries the head of the radius with it, makes a great deformity, and leads to the same disastrous results.

We have ordinary fractures of the shaft. They do not differ from similar fractures elsewhere.

At the upper extremity of the shaft, we have the anatomical neck breaking in old people, the surgical neck giving way

or being broken in younger people. At the lower end of the bone we have, where the bone thins out, transverse fracture extremely common; simple dislocation of the epicondyles breaking off in childhood and having no connection with the joint. The true condyles are broken also, being liable to dislocate the elbow-joint completely; and if restored perfectly to place often give rise to stiffness.

Only one other fracture, which is very rare and of little consequence. Once in a while the external tuberosity gets broken off. It must be a very peculiar force to do it. We recognize it by the fact that it is displaced. We can see it, and feel it in the living body, where the biceps tendon goes through the groove. We can get crepitus. We recognize the fact that the whole shaft and the head and neck rotate together; and there is no breaking off of the true shaft. It is rare, and not very serious; and it merely wants a bandage and rest, to get well, without any serious consequences.

Fracture of the Anatomical Neck. — Fracture of the anatomical neck, I think, rarely occurs before the age of sixty to sixty-five or seventy. It has seemed to me it is more common in fat and feeble old women than it is in males. It follows an ordinary fall upon the shoulder. The bulk of the hospital cases we see are in old persons who fall downstairs. In young subjects receiving a fall directly on the point of the shoulder, the collar-bone gives way; but if the force happens to be received a little below on the tuberosity, in an old person, the anatomical neck gives way; just as the anatomical neck of the femur gives way in the old person. Impaction may exist. It is rare. If it exists, the injury is very hard to detect.

Beyond persistent lameness, disability in making the

motions of the joint and swelling, it is hard to say what diagnostic point there is of an impacted fracture of the anatomical neck. The distance to which the shaft can be driven must be very small. The depth of the bone is very small. It is very unlike the femur, where you can have impaction in a long neck; and consequently the resulting deformity in the way of shortening must be excessively small. With a swollen shoulder it is very difficult to measure or appreciate; so that you may have possibly to content yourself with the idea that this is an old person with persistent lameness, and probably they have a crack of some portion of the neck, or chipping of some portion of the glenoid cavity, and it is hard to tell which.

Fortunately the treatment is the same, — rest with the arm in a sling; and that is all, excepting perhaps the use finally of soothing lotions and light massage, electricity, etc. Be sure to give it four to six weeks of absolute rest, until the patient begins to feel that he voluntarily would like to move it. If it is an impaction, it is sure to get well. If you move it about too much, you render it liable to be made worse than it was before.

The ordinary injury of the anatomical neck is complete fracture with displacement. This gives a certain amount of shortening, not so much shortening and deformity as with a break of the surgical neck. In the latter case one fragment gets drawn into the axilla, and the other in the other direction, and the shortening is considerable and the deformity marked. In those cases you see what I call the second shoulder. It is rather imitated in the gymnasium by the marked deltoid muscles. You see a shoulder, then a groove, and another muscular development, — that is where the break is. That is another shoulder, as I call it. You

find a hinge there. The head remains in place and keeps up the shoulder; but below that the arm drops off, and you move it and find that is the seat of the hinge; and it is a fracture of the surgical neck. This is unlike the deformity, which is very slight, in fracture of the anatomical neck; in the latter you see puffing and bruising, scarcely any deformity. Remember you have here got to make the diagnosis by eliciting crepitus. That can be done by taking the arm and forcing it up, moderately back, and then giving a little rotation. In that way you crowd the fragments together. In fracture of the surgical neck that would not do. You then have frequently to draw down. Of course, you eliminate everything else by an exhaustive examination of the parts beneath the hand, — the collar-bone, the acromion process, coracoid, spine of the scapula. That, of course, can be readily done. You find that the arm is totally disabled. The tuberosities, however, rotate; and you say to yourself any fracture must be above that line, of course. It cannot be the surgical neck. If there is a fracture, it must be the anatomical neck. Push upwards a little, and you almost inevitably get the crepitus.

The treatment is very tedious — six to eight weeks sometimes, sometimes more; eight weeks almost always. It is not wise to put in much of an axillary pad. If you do, you crowd the fragments away from each other. You want to crowd the arm up and treat it much as a fracture of the coracoid process. The elbow is to be raised; fragments forced together. No extension is needed. The axillary pad tends rather to displace the fragments, and had better not be used.

Unfortunately these subjects are so old, that if you have the best possible result after eight weeks, you have got to

contend with a stiff shoulder. Perhaps in some subjects there may be developed rheumatic arthritis. The muscles have got wasted, and it takes a good deal of time to recover the use of the shoulder, especially to make any motion outwards or to get the hand to the top of the head.

Now comes the time, after you are sure that union has taken place, when passive motion, massage, if not too rough, the use of electricity, which I think is very valuable, the use of any stimulating and anodyne liniment, which is often of great comfort to the patient, will greatly restore the usefulness of the arm. Fortunately the use of the hand and lower arm do not depend so very much upon the shoulder; and the patient can have the use of these parts, which are extremely useful, a long while before he is able to get the perfect use of the deltoid and the scapular muscles.

Another result may occur; there is possibility of non-union, just as there is so frequently a possibility of non-union in fracture of the neck of the femur. As a rule, however, fracture of the anatomical neck of the humerus unites by bone.

In the separation of the epiphysis, or fracture of the surgical neck, the fragments are drawn widely apart, ride by each other. The arm is decidedly shortened. The resulting deformity gives a crease below the proper line of the shoulder, which seems like a second joint. By taking the arm and finding the tuberosities and rotating, you find the upper fragment absolutely still, while you move the shaft about under the hand, and that there is underneath a complete fracture preventing any motion being transmitted to the head and to the tuberosities. To elicit crepitus, the fragments having ridden by each other, seize above and draw down and rotate, and, as a rule, you get crepitus.

This unites more quickly than fracture of the anatomical neck, — four to six weeks. It almost always unites.

The treatment has some additional points besides that of the anatomical neck. For instance, a moderately large axillary pad is useful, for it presses upon the upper fragment, which is usually drawn obstinately inward, and forces it out into place. Moreover, we do not wish to confine the arm in such a way as to force up the elbow, because the fragments tend to override and shorten. You want to extend. Usually the weight of the forearm is enough to make extension; consequently the sling should be fastened to the wrist, or the outer third of the forearm, and not around under the elbow, so that the arm may drag. There are cases where we are obliged to make real extension to conquer this shortening of the fragments. In that case, if we wish to do it thoroughly, we have to put the patient in bed. Extension can be put on the humerus just as well as on the femur, if care is used.

Some of these cases override each other so obstinately that they cannot be apposed with the arm down at the side. In that case you put a curved splint shaped like a ship's knee in the axilla, keep the arm constantly out in that position, and bring the two fragments into line in that way. That relaxes the fibres of the deltoid muscle, and forces the lower fragment up into place, and prevents the pulling on the lower fragment by the deltoid. That sometimes is very comfortable and very effectual. The majority of the cases can be treated with the arm at the side; and the forearm in a sling, but not the elbow in a sling. In these cases we use a small pad; then a long inside splint can be carefully fixed at the upper end so as not to injure the axilla. Then we need an outside splint from the shoulder down to

the elbow. An outside splint, when simply a piece of wood, put on in this way does little good, because it does not control the action of the deltoid muscle, which is pulling the fragments all the time; and we have to have a cap splint of pasteboard, or gutta-percha, or leather, moulded on to the arm, and grasping the deltoid precisely as the hand would do it, and then extending down to the external condyle. That is to be very thoroughly and carefully padded to compress the muscles. Then we have the inside splint and then the forearm at right angles, with the elbow drooping. Moreover, having done that, it is essential to put on a body bandage to keep the arm snug to the side, and to prevent the patient from moving the arm.

About four to six weeks are required. You have to take off the apparatus and look at the fracture and readjust within a week; and in a bad case, if there is any doubt about the circulation, you probably will have to adjust the bandage twice within the first few days, not expecting to get the final adjustment until after the swelling has gone down, which is in five or six days. You had better leave it alone a fortnight without looking at it at all after the parts get in a normal condition.

The same treatment afterwards, — passive motion, electricity, etc. It takes a good while, in the strong laboring person, for the arm to recover its full vigor and strength.

Of course, you bear in mind that fracture at the surgical neck does not involve the joint and that fracture of the anatomical neck does; consequently fracture of the surgical neck ought not to leave any stiffness in the joint itself, while fracture of the anatomical neck is rather liable to.

Fracture of the Shaft of the Humerus. — Fracture of the shaft of the humerus may occur at any point, but preferably

about the middle. The fear is of non-union. Union with shortening is not a serious matter, inasmuch as shortening of the upper arm does not impair its utility especially.

The fragments are drawn in various directions, according to the site of the fracture. It is obvious that the flexors, the brachialis anticus, especially, and the biceps, will pull the fragments by each other. The deltoid, if the fracture is at all high up, will have a very important influence in tilting the fracture. The tendency, then, is to overriding and shortening, the fragments being sometimes pulled in one direction, sometimes in another.

The diagnosis ought to be easy. There is shortening and deformity; and by drawing the arm down and rotating the elbow, we get crepitus. Further examination easily reveals where it is. The arm is not a very bulky member, and it is much easier to examine the humerus than it is the femur.

We try to control all these muscles: draw the bone down in place; keep on extension and compress the muscles. The internal angular splint is a good splint. It sets the arm and forearm at right angles, relaxes the flexor muscles, and compresses them on the humerus. The shoulder-cap splint, and the internal angular splint with the elbow bent, complete the number of splints; unless a narrow, straight splint be required on the axillary side. No pad is required in the axilla. The extension is kept up a little by suspending the arm from the wrist, and allowing the elbow to drop.

In case of obstinate shortening and overlapping, it may be desirable to put the patient to bed, and draw out the arm with pulley and weight to keep up extension; but those cases are rather rare. It is especially desirable that the parts should be kept immovable; and after the splints are on, you take them off the first two or three days, and look

after the swelling until they are finally adjusted, and then they had better not be displaced for a fortnight; for non-union is the bugbear of this fracture. Once failing to unite, it seems to be difficult to provoke union by ordinary and simple measures. The best means are to secure perfect immobility for a long while; this failing, we may cut down upon, and wire the ends of the bone. This is a simpler operation than for the femur, and not accompanied by a large mortality. The parts to be looked out for are the artery which winds around the bone, and the nerve which comes out by the insertion of the supinator longus and afterwards goes to supply the radial side. One would think that that nerve could never be cut, but it has been cut by carelessness in a number of cases, and this is followed by radial paralysis, unless union of the nerve can be secured. This risk, then, is of injury to the musculo-spiral nerve or the superior profunda artery, as it winds around the bone, and that is about all. The bone is near the surface, easily secured by wire. Union is generally obtained in that way.

Some curious cases are on record where not only has the humerus failed to unite, not only have the ends rounded off and become atrophied, but atrophy of a large portion of the shaft has taken place. We have such a sample in the Museum, where the greater part of the shaft of the humerus has been absorbed after the injury.

Spontaneous fracture, also, is especially prone to occur in the humerus. Spontaneous fracture is the result of thinning, porosity and atrophy of the bone; and it occurs sometimes almost without provocation. It is thought, usually, that the patient has lifted some little weight, or carried something heavy in the hand. Suddenly, the patient feels a sense of giving way, drooping and helplessness of the arm.

and fracture is found to exist — spontaneous fracture. Non-union or atrophy are the chief obstacles in treating fractures of the humerus. Not that I mean to say that a very large majority of these cases do not do perfectly well; but it is always well to bear in mind the fact that certain contingencies may result; that we cannot safely assure the patient that a fracture of the humerus will result in a good arm. We must bear in mind that non-union may occur in any given case. We cannot say in whom, or why.

It is important to keep the bone still certainly four to six weeks; and, afterwards, flexion of the elbow should be resumed moderately, being sure that the fracture is firm, because the motion of all these powerful muscles attached to the condyles have a strong effect upon the fragment if it is not solid.

Fracture near the Elbow. — Once in a while it happens, especially in young subjects, that what is called a T-fracture of the lower end of the humerus occurs, generally, about two inches above the joint; breaks directly across, and splits down through the shaft as well. The lower fragment is drawn back behind the upper fragment by the action of the long extensor muscles on the back of the arm; and the condyles are split apart and the elbow widened. The appearance of this fracture is very characteristic. It imitates a dislocation of the forearm backwards; and the joint is so much widened, that it looks at first glance like a case of enlarged and diseased bones about the elbow-joint.

The best way is to etherize the patient and to examine the two elbows, comparing the sound with the injured elbow, and the different points of bone upon the two arms will appear distinct, and also difference of position will be easily made out. In the normal arm, the two condyles of the

humerus and olecranon always bear a definite relation to each other. On careful examination, we shall find that the olecranon is always in place; that the whole thing has been carried backwards. If it is a dislocation instead of a fracture, the olecranon projects out far behind its normal position with reference to the other two bones. In the T-fracture, we can recognize at once the fact, that in the injured arm the space across the condyles is immensely widened over what it is in the sound arm. Given a deformity which we prove is not a dislocation; and given the appearance of great widening of the joint with the other evidences of fracture, we are almost sure we have a T-fracture, broken across just above the hollow in the olecranon, where the coronoid process and the olecranon almost meet; and split down through that hollow into the joint.

This, and its parallel fracture, the simple oblique and transverse fracture, are both of them hard cases to treat. The oblique fracture, which is broken across, gives the same appearance of dislocation, which we prove not to be dislocation by examining the arms in the bent position: proving that the two condyles and olecranon are in normal position, and the olecranon not drawn back out of place.

In order to reduce either of these fractures, it is necessary to seize the arm and use the same means as in dislocation. The upper arm is seized, and the forearm, below, and a fulcrum applied at the inside of the elbow-joint, and the forearm pulled firmly forward into place. If a dislocation, it stays in place; if a fracture, it immediately drops out of place. To set such a fracture, to get it into place, requires us to go through precisely the same manipulation as in reducing a dislocation of the elbow; hence a very good rule, that in all these suspected injuries about the elbow-joint, where

it may be a fracture or a dislocation, we should bend the arm, make extension and counter-extension, and pull the joint down into place precisely as if it were a simple dislocation. It is to be retained by an internal angular splint, which is the universal application to all of these injuries, with the single exception of fracture of the olecranon process. The arm at a slightly obtuse angle on an internal angular splint, first going through the motions of reducing a dislocation, and being sure that you apply force firmly, above, in front of the joint, to crowd the upper fragment back into place. In addition to this, it is of vast importance that the manœuvre should be made to press the joint fragment back into place, for most of the deformities and troubles that arise afterwards, in subsequent flexion of the arm, arise from the fact that the fragment has never been reduced, and catches against the forearm, when we make flexion. After a while, by manipulation, we may restore flexion and extension to a fair degree; but find we can never carry it beyond a moderate angle without its bringing up. This condition is without remedy, unless a severe operation is done to excise a portion of the bone and restore the motion in that way. It is always a doubtful question whether we are going to get a better arm than before, if we subject the patient to an operation so near a partially movable joint.

Go through the motions to reduce dislocation; decide whether it is, or is not, a dislocation, partly by the fact whether it stays in place when reduced; also by the fact of the normal position or not of the olecranon and the two points of the condyles. Judge whether there is any injury in the joint itself by seeing whether the width between the two condyles is the same in the diseased and the sound arm; if not the same, you may be pretty sure the crack has gone

into the joint, and one or the other condyle has been separated from its normal position.

The trouble about the elbow-joint in treating it is not that it does not unite, — non-union is almost unheard of. These bones join readily; but the trouble is from subsequent stiffness. If such a disaster does occur, it is best that it should occur in the rectangular position, or a slightly obtuse one. If it is in the extended position, the patient has a most awkward arm of which he can make but little use in any way; hence the importance of putting on the internal angular splint and setting these injuries nearly at right angles, to give the best position, provided subsequent anchylosis takes place in spite of all our efforts to secure mobility.

If we consider that the oblique fracture across the humerus is drawn into place and held firmly, we ought to allow four weeks before we can do much in moving this elbow without displacing the fragments. This is unfortunate, because it allows the elbow-joint to stiffen a good deal. No such length of time should be allowed in fracture of the condyles.

It is particularly important in treating these fractures to look at them frequently the first few days; take off the splints to see that this projecting point is pressed well back into place by padding the internal angular splint. After the swelling has subsided, do up the arm and leave it alone a fortnight, or so. Non-union is not to be dreaded, but stiffness is, in all injuries about the elbow-joint.

Separation of the Epicondyles and Condyles. — The most common accident that happens to little children is separation of the epicondyles; and inasmuch as the internal epicondyle is by far the more prominent of the two, this is the one that ordinarily breaks. Why it does not occur uni-

versally is probably because being carried next to the body it is not quite so apt to receive blows as the outer one, on which the child falls more frequently. The latter is a small affair; and if broken off, it is drawn down by the muscles, and mobility can be felt. The internal epicondyle is quite large, and gives perceptible widening if broken, and you get mobility.

The point of importance is whether the fracture has extended into the joint. This we can easily determine by the fact that if the fracture has gone into the joint and displacement takes place, it must carry with it the part of the bone with which it was articulated. Therefore, if the fracture has gone through the inner condyle into the joint itself, partial dislocation of the ulna takes place with this displacement of the fragment; and if it has gone into the joint through fracture of the external condyle, partial dislocation of the radius is evident; whereas, if under ether, motion of the joint is good and perfect, the radius can be perfectly rotated, the olecranon moves freely, and seems to be in its normal relation to the condyles, then we may be pretty sure that we have to deal only with an epicondyloid fracture, or separation of the epiphysis.

This is a matter of little consequence, speedily unites, and ought not to make any stiffness of the elbow, because it does not go into the joint.

When we find partial dislocation of the ulna or radius, impaired mobility, and widening of the fragments, we feel pretty sure that the fracture has run into the joint.

The treatment of these is practically the same, but the prognosis is different. Age has more to do with it than anything else. If the patient has passed the period of puberty, and is fifteen or upwards, the chance of resulting

anchylosis is very great. If he is still in the plastic period preceding puberty, with the epiphyses partially joined, subsequent anchylosis is not common, and can usually be conquered.

The treatment of all these injuries consists in going through the motions to reduce a dislocation, pushing fragments into place, and putting on the internal angular splint. For injuries of the epicondyles and condyles in the child an external splint is not required. The internal splint is put on, and the elbow left uncovered so that we can watch the swelling, position of the fragments, etc. The arm must be put in a sling in all these injuries. In the fractures about the elbow-joint we can put on the ordinary sling, leave the joint uncovered, and trust to the internal angular splint.

You must bear in mind that in young subjects accurate diagnosis, as a rule, cannot be arrived at without ether; and inasmuch as ether is harmless, it is much better to give it. The injury then can be satisfactorily examined; and if a fracture exists, it can be satisfactorily set.

In these young subjects swelling comes on with great rapidity; and you must recognize at once that if you take the arm and tie it up at first tightly in the internal angular splint you interfere with the return circulation of the veins. Subsequent œdema and swelling come on very rapidly; and I am inclined to think, in a fracture of this kind, if you merely put the arm in a sling without splint or pressure, swelling would still take place to a large degree, but much more so if you compress the vessels and force it into rectangular position. This is the proper thing to do; but we must be careful not to carry it too far. It is best to see these fractures within twelve hours, and within every twenty-four hours for two or three days; until you are sure no

harm is being done by the pressure of the splint and bandage. Œdema will be rapid. Vesications will take place. Ecchymoses, black-and-blue lines from the injured veins and minute vessels injured by the broken bone will soon form upon the arm. The condition of the finger-nails is the best test as to the circulation in the parts above. In the normal finger-nail the circulation of the blood can be better observed than through the skin. We have a transparent medium through which we are looking down upon a delicate papillary structure; and this is of the greatest use in examining the condition of the circulation. No complaint of coldness or numbness should be disregarded.

For the first few days it is not of great consequence whether the fracture is in a tight splint or not. We can be mild in our treatment for a day or two, until the swelling has gone down. The period of swelling and œdema has its natural limit: increases about three days; continues about two or three days, and at the end of a week it has gone. It will not swell again, as a rule. You may then bandage it with safety; and unless you are extremely rough in putting on tight pressure, swelling will not again take place.

Reduce the apparent dislocation of the joint, use the internal angular splint, leave it exposed and cool on the outer surface, put it comfortably in a sling. See it at first every twelve, then every twenty-four, hours. Do not tighten the bandage too early. After the œdema is gone keep the bandage firmly on. How long? We cannot afford to allow the elbow-joint to remain immovable, to heal such fractures, nearly so long as in fractures of the shafts of the bones. The fracture which involves the elbow-joint must be moved earlier and oftener than fractures of the shaft. Most

authorities think at the end of the first week passive motion should be begun once or twice; and then on the seventh, and again on the ninth or tenth, and again on the thirteenth or fourteenth days; and that during two or three weeks passive motion ought to be done frequently. Union takes place. Non-union is very infrequent indeed; and by motion we have the best chance of freeing the arm from permanent anchylosis.

In a little child I think the internal angular splint may be taken off in about three weeks, and in the adult from three to four weeks. Get it off as soon as you can with safety, and put the arm in a sling, in the same position. The child will accomplish a great deal in the way of passive motion, if encouraged to do so. The sling should be taken away a portion of the time, and by and by the child, finding it not painful, will forget it and the arm will drop, and naturally will make the same gradual extension as in the lower leg. The child must be encouraged to carry light weights; to have light calisthenics or gymnastics, and tools to encourage motion of the part. The gimlet, saw, plane — all these things — are extremely useful in overcoming the partial anchylosis, after we know that the break is joined. This stiffening of the elbow after injuries in young children has been so great an injury to them that many surgeons have advised that very little treatment should be used in these fractures; and some have even gone so far as to put the arm in a sling and not do anything else. This, I think, is a risk, for this reason: that if you once get a fragment thrown up out of place, you forever have something that is going to interfere with the joint. The fragments must be pushed down in place, and held in place a certain time, in order that they may remain in their normal position.

We must be especially on our guard that the head of the radius has been pushed well back into place; for partial dislocations of the radius are not infrequent, and give rise to incurable deformity afterwards. The patient becomes very much dissatisfied; because after the parts have healed and the swelling has all gone down, the radius projects very visibly, rotates imperfectly, and the arm never recovers its perfect powers of pronation and supination.

We must pursue in injuries of the elbow-joint a somewhat conservative and middle course. The child should be etherized, thorough examination made, diagnosis arrived at, the joint forced down into its normal position and held a certain length of time by apparatus, of which the internal angular splint is the best. In these injuries about the joint, on the other hand, we should be especially particular not to keep on splints too long, and to begin passive motion very early indeed.

The old internal angular splints, made of wood, with a piece of wire across that allowed them to be moved in certain positions, are not very good internal angular splints. They are not anatomically correct. The best internal angular splint should be bought, or made, *ex tempore*, of tin. The tin splint is, however, rigid and immovable; and, subsequently, if a splint is required which will give a certain amount of mobility, what is called the McIntyre splint, made with a screw, is useful. It is of vast importance to pad thoroughly the parts which are going to fit in the hollow of the elbow-joint. The parts are very tender. The nerve is superficial; veins are there in large number; and compression is painful and disastrous.

Good padding and moderately firm compression, keeping the whole outside of the joint in sight, so that you can see what is going on, are best.

Sometimes pain is best relieved by anodyne fomentations, of which I think the best is laudanum, dilute alcohol and glycerine. About two or three ounces of dilute alcohol, two or three ounces of laudanum and a little glycerine make a very good application; it keeps the skin soft and does not irritate it; and the laudanum has a good deal of narcotic effect. So we must have a carefully padded splint and good position, but not keep it on too long.

Now we come to a point which is much in dispute. Having such an arm come out of the apparatus stiff, what then is the best treatment? Here, there is a great difference of opinion. The older authorities were all in favor of vigorous passive motion, what you might call pumping the arm. The child resisted and screamed. The nurse or some strong person held the upper arm and the surgeon pumped the lower arm, and congratulated himself that he got motion. He got motion, but could not keep it. The next day it swells, is tender and hot. The child is more excitable than ever. The joint is more tender, and a week has to be consumed, perhaps, to get down the swelling, before motion can be resumed. Such being the history, it is sometimes a question whether passive motion accomplishes a great deal. It breaks up the adhesions, but leads to considerable injury. If forced passive motion is to be done, and if we wish once or twice to try that experiment, it is much better that ether should be given, in order that the child may not resist; and we often find to our surprise, after the child is profoundly etherized, that the arm is not so stiff as we had imagined.

On the other hand, the passive motion which does the most good, especially in children, is the passive motion which the patient will give it himself, if you will tempt him to do it; and every means should be used to encourage

the child by games, plays, tools, by rewards, to gradually recover the use of the arm. If the arm is left stiff, if you are uncertain how much can be accomplished, etherize the child once, and see how much can be done. In the subsequent treatment, gentle massage, sometimes electricity, may be tried, to break up the adhesions and lead to motion. It has seemed to me that in these ways we can assure the best results.

X.

SPECIAL FRACTURES.

The head of the radius receives a good many blows. It is quite exposed. The outer condyle does not shield it very well; and it gets a rap frequently. Fracture of its neck is extremely rare. It can be diagnosticated, if present, by putting the arm in the flexed position. Get the thumb on the head of the radius, rotate and see whether the head rotates, or whether we get crepitus. If a fracture exists, it is to be treated on the internal angular splint; the arm to be kept quiet and prevented from supination or pronation for two or three weeks, and then passive motion is to be used.

The more common injuries of the head of the radius are of two kinds: one is partial dislocation of the head of the radius, which occurs in infants and very young children, and is ordinarily produced by the nurse's lifting the child by the wrist. It is a most pernicious practice. The immense weight below acts as a great leverage, pulls upon the radius, and presently the child drops its arm. It will not rotate; it will not pronate or supinate; and there is a slight projection of the radius at the joint. This injury is common in very young children; and it is thought to be a sprain, and frequently overlooked. It is not a fracture; it is not a thorough dislocation; it is a partial dislocation, with subsequent inflammation about the head of the radius.

The child should be etherized, and extension gone through with, and the head of the radius be rotated, and pushed back

into place. Use fomentations a few days, and the child recovers.

The other injury is stellate fracture of the head of the radius. The patient must receive that injury in a very peculiar way. It may occur in connection, possibly, with Colles's fracture; at any rate it is probably produced by the same sort of violence. When a person breaks the radius about the wrist, he frequently does it while attempting to save himself from falling. Falling directly upon the palms, transmitting the force upwards, may drive the head of the radius also against the condyle, and cause the injury of stellate fracture of the articular surface. This is an obscure injury. The patient is lame, sore, he cannot rotate, supinate or pronate. There is an obscure rubbing sound more like tendon than bone. If we are sure that the head of the radius is in place, sure that it rotates under the finger, and can eliminate fracture of the shaft of the radius, and the symptoms continue, we may conclude we have a crack through the head of the radius. The only consequence about knowing whether it is so or not is as to treatment and prognosis.

Rest will restore it; and restoration of the part will be quite complete, if we give it time. Put it in a sling; foment it and allow it to heal. Yet it will be slower of recovery than a simple sprain.

By far the most common injury of the radius is the break just above the lower epiphysis, usually at the junction of the shaft and the cancellous portion, or about three-fourths of an inch above the wrist. This occurs most frequently by falls upon the hand, and is very often an impacted fracture, unlike other fractures of the upper extremity. An impacted fracture — why it is so, you see by looking at these sections

of the bone, showing where the shaft comes down and terminates in this expanded cancellous portion; and when the break occurs, the shaft is driven into the cancellous tissue. It is never driven in without displacement, generally antero-posterior, giving rise to marked deformity.

The other fracture of the lower end of the radius is a complete fracture; and when that occurs, the lower end of the bone rides considerably out of place and the hand goes with it. The peculiar prominence of the styloid process of the ulna, which is so marked in the thin arm, vanishes; and instead of that it reappears as a projection upon the ulnar side. The natural projection of the styloid process is gone; and what appears to be styloid process is a partial dislocation of the ulna. The whole hand drops over to the radial side. The antero-posterior displacement is very marked indeed, giving that peculiar appearance of the two curves called the silver-spoon deformity.

The first thing to attract attention is the loss of prominence of the styloid process of the ulna. When you find that gone, you may be pretty sure that fracture of the radius has taken place. Next, you look underneath and find all the natural hollows of the wrist obliterated, and great protrusion where the wrist should be; and further back you find another antero-posterior projection. If a complete fracture, in a little while you find the ulna pushing out to the ulnar side, the antero-posterior deformity being the most marked.

The first and most important question in recognizing this fracture; which by the way is overlooked about as often as any fracture in the body and usually considered, when overlooked, to be sprain of the wrist; the great point, I say, to be made out when you make the diagnosis that there is a fracture of the lower end of the radius, is whether it is an

impacted fracture, or a complete fracture. The complete fracture, by a little force, is easily drawn into place, so that the natural outlines are at once restored. If an impacted fracture, you draw down and the deformity remains the same; and it will remain so always unless it is broken up by force. Why not leave it as it is? The deformity is not great. Is it not improper treatment to pull it apart, thereby delaying union, it being known to be one of the worst possible practices in surgery to interfere with impaction of the neck of the thigh-bone? Unfortunately, if this fracture is left unreduced, subsequent stiffness, deformity, neuralgia of the hand are sure to result, because projection and pressure on the nerves and numerous flexor tendons here leads to so much displacement and effusion, that neuralgia of the ulnar nerve is extremely common, and great stiffness, and loss of power and strength in the use of the hand itself. There are then very important reasons why this impaction should be broken up. Now simple extension and counter-extension will not do it. You have to exert great force, and it is better to give ether for it. The arm being seized, and the hand extended and bent towards the palm, you compress the fragments with the thumb, and force them down until you break up the impaction — are conscious of lateral motion and complete fracture; and then you pull the parts into place. Then you have converted a partial into a complete fracture; and the treatment for the complete fracture becomes the same for all that class of cases.

The important point would seem to be in treating these fractures not to press the back of the wrist down in such a way, by splints, that we shall lose sight of this arch, which is so marked, under the radius. If we force this bone down so that it lies on a flat surface, we do not have a good re-

sult. This arch must be well supported; and in addition to that, the best position is one midway between pronation and supination, with the hand bent over a roller, leaving two joints of the thumb and all the joints of the fingers free to move.

Mr. Colles, of Dublin, gave his name to this fracture, and first accurately described some of its peculiarities. It almost always occurs from one-half to three-fourths of an inch above the carpal end of the radius, where the hard shaft of the bone meets the soft cancellous tissue. We said it was frequently impacted, though sometimes a complete fracture. I did not say at the last lecture what ought to be said, that this is one of the very difficult fractures to treat and get a perfect result. It is not quite so much so as the collar-bone, for the collar-bone almost always results in some deformity when the fracture is anywhere near the middle of the bone; but, on the other hand, although the deformity at the wrist from this fracture may not be so great, yet its consequences are much more disastrous. A lump upon the collar-bone, which will shorten the shoulder, is of little account except for the looks; on the other hand, the marked deformity from bad union of fracture of the radius is conspicuous, impairs the mobility of the flexor tendons, weakens the ligaments, and frequently gives rise to persistent neuralgic or rheumatic pains, we can hardly say which.

It seems to me the three essential points in treating are: first, diagnosis, for the fracture is frequently overlooked and mistaken for a sprain, with disastrous results. Next, if it is to be set, it must be set at the first visit, or it is never set afterwards. Successful reduction of the impaction and getting the bones into their proper position, or the fragments of bone into their proper position, is the second great *sine qua*

non. And the third one is, that in order to prevent future stiffness of the tendons, confinement of the fingers and thumbs should never take place under the splint; but the splint should terminate at the head of the metacarpal bones, and the thumb and fingers should be left free.

Careful diagnosis, reducing impaction and deformity, subsequently leaving the fingers and thumb somewhat loose and free, seem to be the essential points in order to get a good result.

In spite of all this, and in spite of the most careful treatment, subsequent troubles occasionally arise; and they arise, if the bone has been properly set, in two ways. If the patient is old, and subsequently rheumatism of the fibrous tissues about the joint is set up, rheumatic adhesions and stiffness take place in the sheaths of the tendons; large effusions occur about the palmar surface of the wrist, and on the dorsum, which are not readily absorbed; and loss of perfect motion of the fingers and thumb frequently results in the old, although the fracture may do perfectly well. So we must give a guarded prognosis in the elderly person. The other cause of imperfect restoration is of an entirely different character, and exists usually in younger subjects, though sometimes in middle-aged subjects, but most frequently in females. It is due to the fact that the radio-ulnar ligaments which attach the radius to the ulna; also the lateral ligaments of the wrist-joint, which attach the bones of the forearm to the bones of the wrist, are ruptured, or stretched and sprained, at the time of the fracture, so that the hand is partially dislocated at the wrist; and they do not recover their firmness and contractility perfectly in every case. This is the class of cases in which the following result will be observed to take place: An ordinary Colles's

fracture having occurred, diagnosis having been made, the bone thoroughly set, it comes out of the splints in good position and apparently with an excellent result. The patient is lost sight of, but returns in a few weeks, or months, with lateral displacement of the ulna, partial dislocation of the wrist, and looseness or limpness of the whole articulation. This is due to want of restoration of the ligamentous union. It does not recover its firmness and elasticity so quickly, if at all, as the bone; and this is not noticed, in some subjects, for the first few weeks. For this condition the surgeon should hardly be held responsible; neither should he be held responsible for the rheumatic condition, which sometimes follows. All that he is properly responsible for is to make a diagnosis; to be sure that he reduces the impaction and gets the bones into their proper position; and, subsequently, for a reasonably careful treatment. In the large majority of cases a very fair hand will result — a perfect one in some cases; an imperfect one, according to surgical authorities, in some cases, in spite of the best treatment.

Non-union is not to be dreaded. Union usually takes place, generally within three weeks, and at four weeks is well consolidated; so that we have not that danger to fear. We have rather the danger to fear of imperfectly matched fragments, subsequent distortion, stiffness of the fingers, subsequent relaxation of the ligaments.

We spoke of the fact that this was almost the only case in which it was proper to seize an impacted fracture and break it down and restore the fragments to place. The fact that union is almost sure to occur makes us the more bold to do this; and what we would not venture on in fracture of the neck of the thigh-bone, we may do with safety at the wrist.

The mistake that is made in the diagnosis in these cases is, almost always, that the patient has sustained nothing but a sprain. If seen before great swelling has come on, the peculiar arch-shape of the wrist may make us suspect fracture. Suppose, after all the skill we can expend, the diagnosis is uncertain; it is the wisest plan to treat as if a fracture certainly existed. Draw the parts into place; put them on a splint, and keep them confined a reasonable length of time. Many patients will not submit to this; and many patients do not seek the aid of the doctor. If, however, we have a chance to treat the case, and cannot make a sure diagnosis, we had better treat it as if it were a fracture for two or three weeks; being sure that the treatment of a sprain, in that way, will not be impeded; while, if there is a fracture, we shall get a good result for the patient.

On account of the lateral deformity in the complete fracture of the radius, surgeons were led to employ splints which should press the ulna back into place; and M. Nélaton invented one called the pistol-shaped splint. In that way, by drawing the hand over to the ulnar side, the ulna is forced back perfectly into place. Unfortunately this entails other troubles, which make it a bad mode of treatment to adopt. The great strain put upon the lateral ligament, on the radial side, results usually in a weak wrist, and imperfect restoration of the hand back to its normal position, when the splint is taken off. This splint is now seldom used.

I spoke of the arch under the radius, that it should be well supported by a splint running up under it. No splint is so comfortable as that sometimes called Bolles's splint, or Smith's splint; splints which have been invented here, and used in our hospital a good deal. I would also name Carr's

splint, as fulfilling the same indications. Some people go so far as to treat this fracture without splints, saying if the hand is put firmly in this position with adhesive plaster, a very good result will occur. It is not sufficiently sure as a method of treatment to render it safe to pursue it. You must bear in mind, in all these cases of doubtful result, that you not only want to do the best thing for your patient, but have, to a reasonable degree, to guard yourself against any future charge of having failed to do this or that, which usage has rendered the proper thing to do in the large majority of cases; consequently, unless some very distinct advantage can be shown by a new method of treatment, it is better to use that which has been approved by long experience. The patient is in no way so comfortable as upon a splint, even with a sprain; and in fracture, it seems to be doubly necessary.

The splint must not extend below the head of the metacarpal bones; and the dorsal splint should terminate over the projection of the os magnum; and then fingers and thumb will be left freely to play. If there is much distortion of the ulna, a little pad may be applied, by which the ulna may be pushed in; but that is not always necessary, though it is sometimes. The splint should be seen and watched as to tightness within twelve to twenty-four hours; probably taken off once or twice in the first three or four days, in order to loosen and tighten, as swelling increases or diminishes. The dorsal splint should be lifted off at the end of a week; bandages undone; hand allowed to rest on the roller splint; and the patient should be encouraged to manipulate a little, to see if everything is loose and free. Again, at the end of another week; and at the end of three weeks, it is customary to take off the dorsal splint altogether,

leaving the hand upon the roller, and the under splint only, but bandaged. At the end of four weeks it is safe to take off all the splints, and allow the hand to lie in a sling. You will find one curious thing in regard to all patients, that while they resist and suffer at first from the irksomeness of splints, after two or three weeks they become so dependent upon them, that they are very reluctant to have them taken away. Now comes the time when the surgeon must take the initiative; and if it is a fracture and has united, he must encourage the patient to take off the splint and use the arm. All splints and bandages necessarily atrophy the muscles, and stiffen up all the joints which are connected. The joints become immovable; and this is, in itself, an evil to be got rid of, as soon as union has taken place. This is the case in any fracture, as well as in this fracture of the radius.

Union almost always occurs. Faulty union may occur; and sometimes the question comes up whether it is wisest to re-fracture the part in order to get a better result. If there is much deformity, if there is persistent neuralgia, is it safe to re-fracture the part? After a longer period than five weeks it is extremely difficult to break it over again. Although occasionally it is done under ether, yet frequently the bones give way in a new place; and you have a badly united fracture and a new fracture, instead of the original injury. In children, we may, in four or five weeks, very well re-fracture and re-set the arm; in older people we have to be more cautious; and after a month or so has elapsed, it is wiser to say to the patient, "You probably have got a better result than you would get by re-fracture." State to him the possibilities.

After the splints are off and the sling is used, the patient must be encouraged to use the hand and arm, and have the

motions of supination and pronation, as well as those of flexion and extension made; and it is in these cases, subsequently, that massage and electricity are of great use.

This a troublesome fracture. It is one of the most common fractures we have to treat. Every one should know how to take care of it. The essentials are: first, diagnosis; next, reducing the impaction, getting the part back to its normal look in every way; and, third, not confining the fingers and thumb in a splint, so that resulting good use of them may occur.

Fracture of the Ulna. — Occasionally the ulna is broken, somewhere about its middle, or anywhere along its shaft. It may be broken by a direct blow, because it is a superficial bone, as the tibia is. It is directly under the skin. It is a transverse fracture usually. There is very little displacement, and what displacement there is usually consists in bowing towards the ulnar side, inwards.

It is easily reduced, and very easily treated, and usually unites well. It is not worth while to take up much time with fracture of the shaft of the ulna.

Fracture of the Coronoid Process. — Fracture of the coronoid process is so rare that some surgeons have doubted it; and very few specimens of it exist in any museum. It is to be borne in mind, that in the original growth of the bone the coronoid process is not an epiphysis, and has no natural tendency to separate.

A very peculiar force must be exerted to break it, buried, as it is, in the muscles of the arm; and when it is broken, the upper fragment will be lifted up towards the humerus by the attachment of the brachialis anticus muscle. The joint is unlocked at once. Dislocation backwards takes place. Then the question is, Is it a simple dislocation, or

is there any bone broken which normally holds the joint in place? Of course, we go through all the manœuvres of reducing dislocation and getting it into position, and see if it will stay there. If the coronoid process is broken off, it will not usually stay in place.

The treatment is simple. It is the internal angular splint with a firm pad in the bend of the elbow to compress the coronoid process down into place. If we are satisfied that this fracture exists, and if that treatment is adopted, you must see that treatment should be carried on a good while, to secure consolidation of this little piece of bone against the efforts of the brachialis anticus to draw it out of its place in every movement of the arm. The splint should be kept on five or six weeks. Neither would it do at a very early stage to use flexion; but the accident is so rare that we need not consider it very much.

On the other hand, the olecranon is an epiphysis; it separates easily in childhood, and breaks off easily in the adult, from a fall occurring exactly in the right direction upon the very tip of the elbow. It breaks transversely. To the olecranon process is attached the tendon of the long extensor of the arm, the triceps; and its natural tendency is to pull this fragment up on the back of the humerus. This displacement, however, does not usually occur at first, on the receipt of the fracture; and it is a point on which I wish to insist, because fracture of the olecranon is occasionally overlooked, when it has occurred, during the first few hours, from the fact that great displacement is expected and is not found. In many of these cases you will find, that when you first see the patient, all you can detect across the back of the elbow is a chink in which you can barely put the thumb nail; but by seizing the little fragment and

moving the arm, you may make sure of crepitus. If you see it after twenty-four hours, you will frequently find a separation so that you can lay the little finger between the fragment and the bone itself. The fragment has ridden up quite a distance on the back of the humerus; but this does not take place, at once, on the receipt of the injury.

It is broken across transversely, lies in place. The patient keeps the arm still to resist pain. Slowly the triceps contracts; and if treatment is not administered, after a little while it draws it out of place, and then you can detect it.

In its future slowness to unite, and its imperfect union, the olecranon may be compared to the patella. In many cases nothing but ligamentous union occurs; in some few cases bony union. Ligamentous union is extremely strong and useful, however; and the patient gets along very well, though there may be a slight separation of the fragments.

It is obvious that in order to restore the bone to its normal place the arm must be in the extended position. The moment you begin to bend, it separates and rides up upon the humerus.

Now to get the most perfect result in the way of union, the old treatment, which is still used by many, was to treat it on a perfectly straight inside splint; the patient carrying his arm about extended; the splint going down to the palm and up to the axilla, just as we would splint a broken thigh. It is rather disastrous in its effects. The parts are held in an extremely awkward position. It is a long while before we can venture to get flexion of the elbow; and it is doubtful if the patient gets as good a result as he does in another way.

Among the many wise observations of Hippocrates, there

is described his mode of treating fracture of the olecranon, which is practically the mode we are coming back to. He said that there was ligamentous union; that if we kept the arm too straight and stiff it could not be used very well afterwards. The typical way would appear to be to put on a splint at a very obtuse angle, with a screw to enable you to move it a little every few days. In addition to this, a good deal can be gained in holding the fragment in place by a figure-of-8 bandage of adhesive plaster, just as you hold the fragments of the knee-pan in place by the figure-of-8 bandage.

Pad in the bend of the elbow, figure-of-8 bandage, slightly obtuse angle, and an adjustable splint, seem to give the best results in fracture of the olecranon. This is especially true in the old person; and most of these fractures happen in the old, because in them the bone is brittle. They are apt to fall on the very point of the elbow; and in them, six weeks' confinement in an extended position entails disastrous anchylosis; whereas the partially obtuse angle position, with slight mobility, produces a better result; and even if they have ligamentous union only, they will have, on the whole, a more useful arm.

This fracture, however treated, has got to be a slow affair; eight weeks probably. It will not unite firmly until a considerable length of time has elapsed. So much the stronger reason to have the ability to give a slight motion to the joint, from day to day, after treatment has progressed for two or three weeks.

Fracture of the Radius and Ulna.—Fracture of both bones of the forearm is subject to a variety of disasters. We spoke the other day of the fact that the radius was necessarily twisted out of place by its supinators and pronators accord-

ing to the site of the fracture, and it was very difficult to get these two fragments to lie in an exact line; and in fracture of both bones of the forearm it is practically found that the ulna is held in position, unites promptly, acts as a splint to the other bone; and the other bone, if it unites, usually unites with a distortion, and later than the ulna does. Then another trouble is liable to arise, which is, if the fractures happen to be about the same line, the radial fracture may be drawn pretty nearly into contact with the ulnar fracture, and in the effort of Nature to repair the broken bones she may build a bridge across from radius to ulna, and if that occurs, the radius is tied to the ulna, and the entire power of supination and pronation is forever lost. In what position of the forearm do they lie best apart in order to avoid this contingency? We see at a glance that pronation would be a very fatal position, that extreme supination also is a very bad position; that midway between the two, the bones are most thoroughly apart; therefore, in treating fractures of the forearm mid-pronation is practically the best thing. This, fortunately, is the position which the patient always assumes, if left alone.

Suppose we have this fracture, try to get it into place, push the arm into this position, and hold it by two antero-posterior splints. If those splints are narrow, the result of the bandaging will be to crowd the bones in together; consequently, in treating fractures of the forearm, where both bones are broken, it is desirable that the splint should be a good deal wider than the outer lines of the bones themselves. The whole arm should be flattened down between two broad boards, and held in a semipronated position. Splints have been contrived — perfectly useless, however — and various padding has been contrived, with the idea of pressing apart

the bones, preventing them from pushing together, by a ridge on one of the splints, or a pad put between the splints in a peculiar way. This does not succeed. It cannot press down the two layers of muscles. It only leads to some distress, irritation or sloughing from pressure on the parts themselves, and does not practically do much good.

Union of the ulna is prompt. Union of the radius is slower. Once the ulna joins, it acts as a splint.

There is one great danger of this fracture which has not been alluded to yet, and it applies in a certain degree to all fractures, that is the chance of stopping the circulation and causing sloughing and gangrene from too close bandaging of the parts. It is especially liable to occur in this case, because we have here two bones united by firm interosseus membrane. There are two layers of flexor muscles, in and among which are veins, arteries and nerves. Compression may be very easily applied, with sufficient force to restrain the circulation to a disastrous degree, by bandaging the forearm tightly, because in so doing you press these tender parts upon an immovable posterior wall which cannot retreat and is not elastic; that wall being made up of the two bones and interosseus membrane; and cases of gangrene have occurred under this treatment in this fracture. Before, perhaps, the mischief can be recognized, mortification of the hand or tips of the fingers occurs — an extremely disastrous result for the patient, and for the doctor who happens to treat the case. Here, again, we see the safety of broad splints. You cannot very well compress the arm disastrously with broad splints unless you use extreme force. And here, again, let me speak of another point, and that is in reference to the way in which bandages should be applied where splints are required. It is this, a roller bandage should never be applied next to the

injured or broken limb, but padding and sheet-wadding and splints should be applied first, and the bandage applied outside. This may seem idle to speak of. It is, however, occasionally done with the most disastrous results, because there is nothing to prevent this roller from constricting the swelling parts, and sloughing is liable to take place; whereas, if the splints are put on first and the bandage afterwards, the chances of obstructing the circulation are much less.

Non-union is to be dreaded here. Non-union of both bones is not very rare. It gives rise, when it occurs, to a useless arm. There is a false joint and but little can be done with the arm. When this occurs you have two alternatives. One is a serious operation — cutting down upon the ends of the bones, scraping back the periosteum, sawing off the rounded parts, shortening up the forearm, fastening the two ends of the bones together, and treating it as a compound fracture. You may frequently get a good result in this way. It is a somewhat risky mode of procedure. If the patient does not wish to do this, if he has not the constitution to stand it or is too old, you have another resource, — to keep the arm permanently in splints. The splint is the internal angular splint with a flexible elbow, padded with chamois. The patient puts it on and off, bathes the arm, keeps it healthy. That does very well. The other is the only way to make the parts unite.

Fracture of the Carpus. — Fractures of the carpus are rare unless they are compound. The treatment is to push back the broken bones into place; bandage lightly on a splint; look out for effusion. These are usually compound fractures. The bones of the carpus are rarely broken except by some crushing violence, which has broken through the tissues.

Fracture of the Metacarpal Bones. — Fractures of the metacarpal bones, on the other hand, are not uncommon, and the most frequent place for them is near the knuckle, near the distal end of the metacarpal bone. Occasionally, the metacarpal bone of the fifth finger on the ulna side is broken at the middle from a blow. Once in a while in consequence of a severe blow this large second bone is broken; but the usual fractures are down near the distal end, towards the phalanges.

The best way to examine the two hands is to shut them and look at the knuckles. We see, often, a knuckle missing where there is a fracture. We say, at first, that there is a dislocation, that the finger has gone backwards into the palm; on the other hand, it is a fracture, and the head of the metacarpal bone and finger have dropped together. Put your finger underneath and press up, and it comes up into place and the line is restored; and by manipulation we can find crepitus, and be sure of the fracture.

This indicates the line of treatment to be pursued in fractures near these distal ends. Support must be from below. Putting the hand over a ball is good treatment. A large splint that holds the whole palm is also good treatment.

Union is slow. If you discontinue treatment too soon the bone sags, and subsequent deformity results.

Fractures of the Fingers. — Fractures of the fingers, phalanges, are, of course, easily recognized and easily treated. The point to be borne in mind is that there is liable to be deformity in two directions, as the finger recovers. We all recognize and try to treat, and usually succeed in treating well, the antero-posterior deformity of broken finger; but the lateral deformity is to be looked out for as much; and you must have the finger set straight in

both directions to get a good result. If you use little wooden splints to support the phalanges, you need four. If you use tin splints, they should be such as to support it below and on the sides. You must look to it that the finger is got perfectly straight, and not allowed to deviate to one side as the treatment goes on.

The finger bones unite quickly; and non-union is not to be feared. The only thing to be feared is, when the fracture is very near the joint, that we may have some resulting stiffness, and not have the perfect use of the flexor or extensor tendon.

XI.

SPECIAL FRACTURES.

Fractures of the Pelvis. — To go over the anatomy of the pelvis for a moment: the ilium, ischium and pubes, being three separate bones, afterwards consolidate at the acetabulum. The acetabulum is a little Y-shaped piece in the fœtal state, which is an epiphysis. The three bones unite around this little piece. The acetabulum is a weak point in the bone; and up to the period of adult life, if a fracture of the pelvis takes place, it is very apt to run into the acetabulum, in the line of these old junctions. Setting that aside, there are quite a number of epiphyses which are liable to be broken off. The spine, the lip, the crest, the inferior spine, the tuberosity, — those are points likely to give way in the young subject, unless the fracture takes place through the acetabulum itself.

The fractures of the pelvis in the strong person occur usually in consequence of crushing injuries. Something must seize the pelvis and compress it, either laterally or antero-posteriorly, in order to break it, for it is usually quite strong. Persons occasionally get caught between moving cars, or between the wheel and body of a cart; or occasionally when a person is at work trying to bring a vessel into a wharf; or at ferry-landings, where persons jump off in a hurry, and get caught between the boat and the dock. The next most common cause, I think, is the fall of banks of earth. This crushes and compresses the pelvis.

Fracture of the Crest of the Ilium. — The simplest one is the fracture of the crest of the ilium. It gives rise to but few symptoms. The patient feels very sore and lame about the attachments of the muscles of the abdomen, and on examination there is found a displacement inwards of the crest, and mobility. Crepitus can be found. It unites easily. It is apt to unite with displacement inwards. Bandages put on to hold it in place make it worse. The patient should be kept in bed, with sand bags, perhaps, around the pelvis; and be encouraged to lie still without any direct pressure upon the crest of the ilium.

Union takes place in three to four weeks. It always takes place. I think the resulting injury to the patient as regards the use of the part is slight, if anything at all. The danger in all fractures of the pelvis is in injury to the pelvic contents; especially the bladder, and occasionally the rectum. The bladder may be displaced, removed from its delicate cellular attachments, or torn, or ruptured, by a fracture of the pelvis. In the same way the rectum may be wounded; or the delicate spaces around the rectum may be impinged upon by broken bones and effusions of blood in such a way as afterwards to lead to a pelvic cellulitis and abscess, if not to absolute peritonitis. The important point, then, about fracture of the pelvis is the condition of the viscera inside; and these are to be investigated carefully both subjectively and objectively.

In investigating fracture of the pelvis we have a much better opportunity to make a complete diagnosis in the female than in the male, because we have by means of a vaginal examination the ability to map out most of the outlines in the adult pelvis, and to seize the parts within, and compress them outside, and see whether crepitus as well as displace-

ment exists. We have this opportunity, in less degree, by a rectal examination, in both sexes. When doubt exists, we should examine by the vagina and rectum in the female, and always by the rectum in the male.

In regard to the condition of the viscera themselves, we can judge about the bladder in two ways: first, by the intensity of the immediate symptoms; and, second, if these do not exist, by the condition of the water that the patient first begins to pass. It is one of those questions we should always ask and have attended to, the first few times the patient passes water after an accident about the pelvis. Where it is absolutely free from blood the first time, there may be blood in the urine the second time. I have seen it occur several times, that the water passed the first time was clear, but the second time it began to be tinged with blood. The patient first passes off the superficial fluid. The leak begins to bleed; then it bleeds enough into the bladder to give blood with the urine on the second passage. So also we await with a good deal of anxiety the first passage from the bowels; whether that will come down free from blood, and demonstrate that the rectum is whole. Of course in severe cases of crushing of the pelvis, where the parts have been terribly injured, we have immediate symptoms of great collapse. If the bladder is torn, intense and burning pain about the pubes comes on; the patient makes efforts at passing water without success. If the peritoneum has been involved, we have rise of temperature and all the signs of peritonitis.

We have in the vagina and in the rectum invaluable means for diagnosis by making careful explorations.

Fracture of the crest of the ilium requires but little treatment. Other fractures which run through the pelvis require treatment according to location. They all require

absolute rest in bed, with the patient on the back, with the knees slightly flexed, in order to relax the mass of long muscles of the leg which take their rise from the pelvis. In addition, it is of extreme importance and comfort that the pelvis should be held together by a firm swathe, which will compress the bones. A swathe is a very awkward affair, and constantly getting out of place; consequently an apparatus made a good deal like bathing-tights is most useful. In order that this may be applied with ease, all the parts must be laced. In that way everything can be drawn firmly together. It never slips out of place. It is constructed with a view of not chafing the patient, or interfering with the action of the bowels. It is made of heavy material, and fitted as one would fit an elastic jersey, or something of that kind, to the limbs. He must lie persistently on the back; and this apparatus must be kept on a long while — two or three months usually, if the fracture runs entirely through the pelvis. If, in addition to this, we are reasonably sure that the fracture has passed through the acetabulum, this treatment alone will not be sufficient; and we must combine with it the ordinary treatment for fracture of the thigh — extension and counter-extension.

The fractures of the pelvis which are the most troublesome are those which pass through the acetabulum — troublesome to diagnosticate and treat — and they give the worst prognosis. The acetabulum being broken through somewhere about its epiphyseal lines, we shall have crepitus and the ordinary signs of fracture about the neck of the femur, but no shortening, and not necessarily any eversion of the foot. Marked eversion, with the femur unbroken, indicates a through and through fracture of the pelvis. Seizing the pelvis with both hands, sometimes, and compressing it, we

elicit crepitus. Sometimes we get crepitus on examination by the rectum, or the vagina.

This requires a pelvic band, long rest in bed, and the full treatment for broken thigh, for a considerable length of time.

The result which we get will be union, but probably not smooth and comfortable to the patient. Stiffness of the joint, subsequent arthritis, etc., are common sequences of this fracture. There will be a more or less stiff and uncomfortable hip-joint from the fracture.

Fracture of the Sacrum. — Fracture of the sacrum can be pretty easily detected from the outside, for the sacrum is rather superficial. It can occasionally be detected by examination by the rectum.

It is difficult to restore the position of the sacrum when broken. It may be done possibly by violent pressure from within the rectum. Such cases must be treated by very gentle pressure with a pelvic band, and by keeping the patient in bed. Union is pretty sure to take place. The chance of its breaking through where some of the great nerves emerge is possible, with subsequent sciatica.

Fracture of the Coccyx. — Fracture of the coccyx presents no external signs except that the patient cannot sit down without great distress, and complains of a hard or straining passage from the bowels. Fracture of the coccyx can hardly be overlooked if we examine properly by the rectum. Passing one finger well up into the rectum and having the thumb outside on the coccyx, you have complete control, and can tell whether there is mobility or crepitus. In addition, we often find that the coccyx is abnormally tipped in; and we can push it back into place. Usually it can be pushed back, temporarily at least, into place. It is

important to rectify the position, inasmuch as if left, it interferes with the action of the bowels, causes tenesmus, and is apt to produce neuralgic pains. Coccyodynia is apt to result, and sometimes requires operation to relieve it. I have seen one or two cases of fracture of the coccyx do well under the following treatment: clear out the bowels thoroughly; replace the coccyx into position by the finger in the rectum; keep the patient on the side in bed, and do not let him lie on the back; keep the stools perfectly soft, which is best done by daily small doses of castor-oil.

The slight injuries of the coccyx which happen from persons being thrown from a carriage or sleigh, or falling on some sharp substance, the top of a chair for instance, produce a bending of the coccyx without fracture. They strain the ligaments, bruise the parts, lead to subsequent spasm of the little coccygeal muscles, and to a rheumatic condition, or to some sort of an inflammation of the ligaments of the coccyx itself. This is frequently the seat of long-continued neuralgic pain, and is sometimes relieved by dividing the ligaments; sometimes it has to be treated by excising the coccyx itself, which is not a dangerous operation if properly conducted, although the hole that is left will surprise you by its depth and size, and take some time to heal up. The average results of any operative interference are not very encouraging.

Fractures of the Neck of the Thigh-Bone. — The neck of the thigh-bone differs very much at different ages. In the young subject it is at a very slight angle from the shaft. In youth it becomes a little more oblique; in adult life it is at a greater angle; in old age it is almost transverse; and in addition to that, it is shortened.

As to the anatomical structure of the neck of the femur,

the posterior edge has the thinner wall. It is made up of cancellous tissue partially. The thinner wall being on the posterior part, after moderate injuries it is the back wall which breaks first; and if that gives way, then the femur rotates (just as it would upon a hinge) upon the back wall, and the foot turns out. That is the usual history. In complete fracture across, the foot turns out, from the loss of control of the obturator muscles.

The fact of this different structure of the bone, and its different positions in different ages, apparently explains why it is that fractures of the neck of the thigh-bone, which are complete, are very difficult to make unite again after a certain age. Bony union, it is asserted, almost never takes place beyond the age of sixty. I have seen what I supposed to be bony union at the age of fifty-four or fifty-five. Even when a person has passed fifty, judging by the constitution and the relative age, we may infer whether they will have sufficient vigor to unite the fracture of the neck of the thigh-bone by bone.

Various reasons exist why this should be difficult to do. In the first place, the upper fragment, as you see, is like one-half or two-thirds of a billiard ball, lying in the socket, bathed in the synovial fluid, having no nutrition except that coming from the ligamentum teres. When there is a complete fracture, the neck rides out of the socket; the femur is gradually drawn up out of the socket; the limb is very much shortened; the parts do not come in apposition; and it is difficult to keep them in apposition, indeed, by treatment. Not only does shortening take place, but, in addition to that, the femur drops back by gravitation as the patient lies in bed.

Want of apposition, want of perfect nutrition, and the

general feebleness of the parts, are the causes of failure of good bony union in this fracture.

On the other hand, there is another species of fracture of the neck where separation of the fragments does not take place. This is called impacted fracture of the neck of the thigh-bone: and it occurs from the strong bony tissue of the shaft being driven into the neck and head; the posterior wall of the neck, which is the thinner, giving way; and more or less impaction taking place at a greater or less angle. By that I mean that this may possibly take place, with the foot directly forward, or in the position of moderate or extreme eversion, according as the bone is driven in posteriorly, as you must see.

Impacted fracture of the neck of the thigh-bone takes place at the same age as the complete fracture; and it is much more likely to occur in the middle-aged and old than in the young; just as in the fracture of the anatomical neck of the humerus, it is especially in middle life and advanced age that that occurs. In extreme youth the epiphyses separate; in adult age the bone breaks at the surgical neck.

The force required to make the neck of the thigh-bone crumble or yield, either to impaction or fracture, is sometimes so slight, in advanced age, that the theory has been advanced, when a person falls and a break is found, that the fall is subsequent to the fracture. Sometimes, probably, this is true; for the violence of the fall is occasionally so slight that you can hardly consider it enough to produce fracture. Old women will sink down on the floor of a softly-carpeted room, perhaps a distance of two or three feet, and be found to have either impacted, or complete fracture of the neck of the thigh-bone. The slightest possible accidents seem to be coincident with this fracture. Whether

they are always the cause of it we have no means of knowing; or whether, possibly, the bone may give way first.

Moreover, there is another very deceptive point. It is this: that in these fractures when the patient merely slips down on the ground, as happens sometimes, the patient is not at first rendered so helpless but that he or she can stand, or walk a few steps, after an impacted fracture; but not after complete fracture of the neck of the thigh-bone. Instances are known in which patients have ascended two or three steps of a flight of stairs, before giving out.

A great deal of importance has been laid, as to the chances of bony union and good repair, on the fact whether the line of fracture, in a complete fracture of the neck of the thigh-bone, was entirely inside the capsule, outside the capsule, or partially inside and partially outside. A fracture outside the capsule of the neck, outside the socket-joint, is as likely to unite by bone as a fracture of the shaft, or of the trochanters themselves. In proportion as we approach a complete intracapsular fracture, we approach a point where non-union is liable to occur; but to diagnosticate the exact running of a fracture partially inside and partially outside the capsule is probably beyond our knowledge. Some authorities pretend to do it. There is an anatomical peculiarity which is well recognized and has been written upon, which rather gives discredit to this assertion. It would be, in the first place, down through the deep tissues of the buttock, extremely difficult to tell exactly where a fracture had gone with reference to the capsule, even if we knew the exact position where the capsule is. We know where it ought to be. It varies. In some joints it is higher; in some it is inserted lower upon the neck; and if you take this doubtful anatomical position of the capsule itself, and the diffi-

culty of detecting a fracture which may run one-fourth of an inch one way or the other, above or below the neck, you must see the difficulty of the diagnosis of partial intracapsular fracture from entire intracapsular fracture. It is quite clear when we get a fracture outside; we can recognize crepitation directly under the trochanter, and other signs; but when it gets in the vicinity of the capsule, to tell whether wholly inside or out, I am inclined to think is beyond the ordinary run of wisdom or of guessing.

Symptoms of these two classes of injuries. They are sometimes so slight that they are unfortunately overlooked. The patient has a fall the like of which he has had many times before without sustaining the least injury. He becomes incapacitated, and cannot walk; and the friends, and often the physician, are ready to ascribe it to a contusion, or bruising, or neuralgia of the part, rather than to a fracture. The subsequent symptoms at first are so slight that this sort of fracture is very liable to be overlooked.

The impacted fracture. The patient has a very slight slip or fall. He gets up and steps a step or two, and he says he cannot go any further. On being examined it is rare that any bruise of the external parts is found. Such patients usually fall with a good deal of clothing on; and on some place perhaps where it is soft, and a bruise is not common as it is in other fractures. Subsequent swelling comes on; but that is after a day or two. There is not much to guide to the seat of the injury except the nature of the fall and the nature of the pain, which is marked and localized. On having such a patient put to bed and the two legs carefully compared, it will be found that there is a slight shortening and considerable eversion. Great eversion is not always the fact; and occasionally the foot may even

be inverted, in some forms of impacted fracture We should readily distinguish the inversion of this fracture from the inversion of a dislocation on the dorsum, from the fact that in dislocation on the dorsum we must have a shortening of one and a half to two inches, and in this fracture we should have a scarcely appreciable shortening, one difficult to measure; one-eighth to one-fourth of an inch, perhaps, marks the outside limit in the simple impacted fracture of the femur. One-fourth of an inch is the common thing, and with moderate eversion, inability to rotate the foot in. They can move the toes in if they make great effort. In addition to this we should not gain much by rotation of the trochanters, because although the arc of the circle through which it sweeps may have been shortened, it is not like the spindle-shaped motion when the shaft is broken completely off. In impacted fracture, then, with slight shortening and eversion, if we examine here and rotate, we shall not appreciate much difference in the arc of rotation from the normal state. These are about the only signs; and they are very slight. If such a case is overlooked, the patient will struggle to sit up, and will be taken out of bed into an easy-chair and begin to try to move about; and, either after a long time the part will slowly recover at the expense of a great deal of pain, or, what is more common, the first violent motion of any kind will produce a complete fracture. Total disability will follow, and complete eversion, and a powerless and shortened limb. This, then, would emphasize very much the importance of not churning about such a suspected fracture too much to get crepitus; for if we have converted the impacted into the complete fracture, we have added very possibly a ligamentous union.

A slight injury, very slight, no bruises; the patient is not

able to believe at first that anything can be broken; tries to stand, has to give it up; has great pain (being already fifty-five to sixty years of age); he is found to have slight eversion, slight shortening, inability to rotate the foot in, pain localized perfectly about the neck of the femur; and that is all. Those are the symptoms of moderate impaction.

On the other hand, in the complete fracture of the neck of the thigh-bone, as a rule, the patient has a similar fall, not necessarily a more violent one It depends upon the age of the patient, condition of the bone, and the reception point of force, whether or not he will get a complete or impacted fracture.

The signs differ a good deal from those of impacted fracture, and the signs are very important to distinguish between these two.

Complete fracture usually gives a shortening of one to one and a half inches. At first this shortening does not take place. It comes on gradually. At first we have slight shortening with eversion and helplessness. The next day shortening will take place, unless some treatment has been applied to draw the limb down. In addition to this the foot is laid off in an everted position. It is completely helpless. The patient can hardly lift the outer side of the foot from the edge of the bed, and cannot invert it to anywhere near the extent he can in an impacted fracture. Pain is great on manipulating the limb. If ether is given, in the early stages, by drawing down gently, and bringing the shaft opposite the neck, we shall generally get crepitus; but we shall get at any rate one other sign, and that is, examining the trochanter, we shall find instead of sweeping through its normal arc, it merely rotates feebly. We can get it more particularly if we seize it; and with the patient

etherized, and a person taking the knee, we can see whether this bone rotates through the arc of a circle which comprises several inches, or merely turns on itself. If the latter, you may be quite sure that the neck of the femur is broken off. In addition to this, if the case is untreated for ten or twelve hours, you will have increasing shortening, until it amounts to one, or one and a half inches, in very many cases. We all know how difficult it is to make an accurate measurement as to shortening; and a number of observations must be made and the mean taken. Great care must be taken to place the patient exactly straight on the bed, to have the limbs alike, to have the everted foot held up so as to correspond to the other, that the knees shall be down flat, that the patient shall have no pillow. The surgeon should look at the patient from the foot of the bed, and see if he can draw a line directly through the body to the axis of the head, and then proceed to measure from the anterior superior spine to the inner condyle, and from the umbilicus to the inner condyle; and usually he will detect shortening by both of these measurements, sometimes not exactly corresponding. If one gives one-half inch, and the other three-fourths, he must compromise, and conclude that the true shortening lies between these. This is of no matter one way or the other, except for purposes of diagnosis; and in that way it is of considerable importance. We know when the femur is drawn out of the socket on the dorsum, that it is pulled up and shortened a couple of inches. When we get a fracture of the shaft of the femur, we get deformity in the contour of the limb and great shortening at once. On the other hand, when we get a fracture, impacted, of the neck of the thigh-bone, we get very slight shortening, with eversion; and with complete fracture, considerable shortening after a time, but not at

the first moment when the accident occurs. Do not be deceived into the idea when you are first called to a suspected fracture of the neck of the thigh-bone, that it cannot be wholly broken off because at first considerable shortening does not exist. You must take all the signs together; examine carefully again during the next twelve hours, and you will probably arrive at an accurate conclusion.

In addition to the chances of getting no union, the patient, if advanced in life and at all of the rheumatic diathesis, is liable also to have a great effort of nature to throw out bone in the wrong place. He will not join the broken part; but throws out bony growths about the socket, and perhaps about the trochanters; the result of which is indurations, bony osteophytes occurring at various points, pain, and more incapacity of the limb than if the patient had not undergone this rheumatic change. We have got to take that into account in making a careful and guarded prognosis with regard to the future utility of a hip-joint injury in an old person. This change may come on after impacted fractures; and it is not safe to say to the patient, "Your bone is cracked, not broken off, and in a few weeks it will join and be as useful as ever," for that is not always the case. In addition to this, a great many of these patients suffer from sciatica, which is annoying, exhausting to the patient, leads, of course, to wasting and non-use of the muscles about the hip, and subsequent more feeble use of the limb for a long while. This also has to be taken into account.

Now, as to the treatment of these two classes of injuries. It is evident that every effort should be directed to prevent an impacted fracture from being separated from the place where it has been forced in. We are willing to have a little shortening, to have eversion, provided the impaction can

stay; because that assures us of a firm bony union. To extend the limb by weights is to risk breaking it off. No extension should be used after an impacted fracture, except with the idea of steadying the limb. It is important that the parts should be held still; and it is best accomplished by the pelvic belt. Put a pad up behind the trochanter, which they cannot shift about and lie on — a pad of hair or cotton, or a little sand bag, which will hold the weight of the trochanter up; the pelvic belt; and additional sand bags to lie about the limb to correct the eversion as far as possible, and to keep the patient as still as possible. In this impacted form, this mode of treatment seems to give very fair results. If we can get along in the old person without long internal or external splints or extension, we by so much diminish their suffering, and the chance of bed-sores, and they generally do better and get about sooner. In the impacted fracture, when we are quite clear about it, we should not manipulate it too much; should support the back of the trochanter; support with a pelvic belt, use sand bags and rest. Six weeks usually will suffice to get into the condition where the patient can sit up in a chair. After a while the neck will get quite strong, and with the exception of slight shortening and slight eversion, the patient frequently does very well.

On the other hand, in the complete fracture of the neck of the thigh-bone, we cannot be quite sure whether we are to have bony union or not; and we know that if we let the part alone, the muscles within the next twelve to thirty-six hours will pull the lower fragment far up beyond the upper one and produce shortening, and that no union can take place because the parts are not in apposition. Moreover, in addition, this muscular contractility keeps the patient in

constant pain; and therefore in this particular injury, at any age, I am inclined to think a moderate extension by weight and pulley, for a while, at least, is a useful mode of treatment. It overcomes muscular spasm; overcomes the pain; draws the parts down into contact; keeps them at rest; puts them in a position where they can unite, if there is any union to take place. The objection against using extension and apparatus on these old people is that occasionally the shock and confinement kill them; and where they show any signs of flagging we should accept the fact that the chance of life is better than any disability about the hip. We should take off the apparatus, and put them on the double-inclined-plane chair, perhaps. In that way we may save life; prevent disasters by sores; retain for them, perhaps, control over the bladder, which is frequently lost; and they may live a number of years. If they are strong enough in the arms and shoulders they get along; for they will be able to use crutches and go about. Many of them live for years, and go about on crutches, with a ligamentous union and a dangling and everted foot. That is the reason why it is sometimes dangerous to use extension; but if the patient can tolerate extension, I am inclined to think a moderate degree of it is indispensable in the early treatment — not applied with the same rigidity or hope of union as we should in fracture of the shaft of the femur, but as a conservative measure to relieve the spasm and pain, and to put the fragments in proper position, and, in addition to that, to keep the parts quiet until Nature makes the next change, which she makes if union is going to fail. This change consists in rounding off and smoothing the fragments and leading to a sort of fibrous union; and after that change has taken place, the parts are no longer painful; do not rub together; slide smoothly on

each other; and are protected by a species of false membrane. Extension can then as well be taken off as not, for no further relief is to be expected from it.

In old times the whole treatment of fractures of the lower extremity was so much more rigid than now, that the patients, even in vigorous life, frequently got bed-sores, frequently got bad ulcerations of the perineum from the straps that were applied for counter-extension, not infrequently sloughing of the heel from the foot being held in a firm box so long. No wonder that the older surgeons, seeing these disasters in strong subjects, should find that they were pernicious and fatal to an old person.

Now, on the other hand, we have fortunately altered that, and the treatment of fractures of the lower extremity is not so severe. Bed-sore is rare. Sloughing of the heel is practically unknown. I have not seen one for many years in treating fractures. The perineal strap has been wholly abandoned. The modern treatment of fracture of the thigh is extension by weight and pulley; raising the foot of the bed; preventing rotation outwards of the limb by a long splint or sand bags; and this can be much more safely applied to an old person than the former harsh treatment could be.

These are the arguments, pro and con, in treating complete fracture of the neck of the thigh-bone. Moderate extension, carefully applied, is useful, for it may lead to union. If union has failed to take place after six or eight weeks, there is not the slightest hope of its taking place. Then extension should be abandoned, and the patient got up on crutches; and massage should be used to strengthen the muscles about the joint.

In a certain proportion of cases we shall be annoyed by

the persistence of roughness and grating in and about the joint, which is not due to the fracture, which has been rounded and softened in a false membrane, but to the occurrence of chronic rheumatic arthritis. That is the bane of this class of injuries; and it is difficult to do much for the comfort of the patients, unless they can wear some sort of leather splint or support, which will prevent much motion of the joint; or are sufficiently strong to wear a Sayre's apparatus, which extends the leg a little, and allows the patient to walk without much motion or friction in the joint itself.

XII.

SPECIAL FRACTURES.

Fracture of the Greater Trochanter. — It happens occasionally that a person breaks off the greater trochanter. That can be easily diagnosticated, because the trochanter is so superficial that we can feel it through the tissues, grasp it and detect crepitation.

If it is a fracture of the trochanter alone, then we can apply treatment by the pelvic belt and gentle extension, and keep the parts quiet, and we are sure of union. If it is a fracture through the trochanter and the neck, we must treat it as a fracture high up, either in the straight position, or sometimes, if the fracture occurs below the trochanter minor, then in the double-inclined-plane position, which will favor the approximation of the fragments.

When the femur happens to be broken off just below the lesser trochanter, the upper fragment is strongly pulled upon by the posas and iliacus muscles. The injury throws them into spasmodic contraction. They are ordinarily so strong as to move and evert the fragment. Everything is gone except this little piece, and they seize this and turn it, and tip it outwards. The shaft goes, usually, backwards; and no approximation of the fragments is possible, without great care. It is sometimes possible in the straight position to get this fragment down to match the shaft. If you are unable to do this, you must bring the lower fragment up. So that it is this class of fractures that is best treated on the double in-

clined plane. That is Nathan Smith's method of treating fractures of the thigh. Nowadays most fractures of the thigh are treated in the straight position. It is a noteworthy fact that Hippocrates treated fractures of the thigh in the straight position. People got dissatisfied with that; and two or three centuries ago they treated them all on the double inclined plane. Now they are almost all treated in the strictly horizontal position, once more.

When an old person falls and break the neck of the thigh bone completely off, you apply treatment; and the two questions always asked are: Is the patient going to be lame afterwards? You can safely say, "Yes." If they do well they will go on crutches a long while. If they do extremely well, they will be able to use a cane; but not be able to go without a cane, in all probability, for the rest of their lives. How long are they going to be confined? That you must put at a long period. The treatment that you apply to complete fracture of the neck would not cover more than six or eight weeks; but the subsequent recovery of the powers of the old person always consumes months; and four to six months is perhaps none too long to say, before they get to moving about freely; and, of course, in a limited class of cases you would say, this person is so old and feeble, having already reached the age of eighty, or more perhaps, that it is hardly worth while to subject him to hard confinement and to apparatus; but the better way is to put the patient of that age upon a soft bed with springs and mattress so arranged and divided that the bed can be tilted about on a double inclined plane; and subsequently get him on a lounge or chair of the same plane; and look after the bladder. Look after bed-sores. Keep up the nutrition without applying rigid apparatus. Be cautious about applying bandages

firmly to the parts, for you run a great risk of so interfering with the circulation, that gangrene may be set up in the toes, to which they are extremely liable. In the first place, as you know, the venous circulation on the surface is extremely sluggish; the vessels are much dilated. In addition to that there may be atheroma of the arteries, which has reduced their calibre and elasticity so that the nutrition of the extreme parts of the foot is very poor. Such a limb will stand very little exposure to cold; will heal very slowly if it is injured; will slough very readily if it is compressed by a bandage or apparatus.

Fracture of the Femur.—It is this bone which gives rise to the greatest number of cases of shortening; conspicuously so because it supports the whole weight of the body, and because it is small; and also, especially, because the muscles that are attached around it are so powerful. When the femur breaks, shortening is immediate and considerable, and amounts frequently to an inch within the first few minutes. The deformity of the limb is very marked. The limb appears twisted out of place as well as helpless. The muscles above are irregular, and the deformity of outline is always considerable in fracture of the femur. Shortening and deformity. In addition to that, if you draw the part down, you get crepitus; and a hinge or false joint in the middle of the thigh, for instance, is very conspicuous when you try to lift so large a portion of the body, so that the signs of broken femur are marked from the beginning.

In consequence of the power of these muscles, shortening is very difficult to overcome by extension; and it frequently happens as the result of treatment that a considerable shortening remains. I think I said in the beginning of this course, that recent measurements, conducted in a number

of museums, of specimens of fracture of the femur, for instance, had proved that that bone especially, of the long bones, never united without shortening. This may be qualified a little perhaps in the case of the femur of children, where the break is usually transverse, and where union without shortening frequently occurs. In the adult shortening is the rule.

How much shortening is to be considered a fair result? Experience has proved that a patient will walk without perceptible limp with three-fourths of an inch shortening. He may need possibly another lift upon the sole and heel of the boot, but will not limp perceptibly with three-fourths of an inch shortening; for the pelvis tilts, and the whole side of the body accommodates itself to that shortening, without showing appreciable lameness. What is called a first-rate result in broken femur is one-fourth of an inch shortening. One-half inch does not make us ashamed. Three-fourths of an inch is not desirable; but still we may feel that the patient is not going to be lame, and conspicuous to himself and others. Beyond three-fourths of an inch marked lameness occurs; and instances are seen, frequently, in which, either without treatment, or from unfortunate treatment, shortening results of from one to one and a half inches.

We may then in attending a fracture of this bone expect to be able to make an easy diagnosis; expect to have a case that will require treatment and a great deal of care to avoid shortening; and expect to have some shortening any way; and it is just as well, if anything is said upon the subject, for the patient and his friends to understand from the beginning, that no treatment can make a broken bone, of that character, as long as it was before. They must be made to

understand that it shortens in mending. That is true; but there is another point true, for which we are responsible if we allow it to occur; and that is this, that after union has taken place to a pretty firm degree, if we allow the patient to go about too soon upon such a bone (as it bears such a weight and is so small), subsequent shortening will take place after union has occurred, from pushing up, shortening and shrinking of the soft callous union, which has not yet become bone. These are the cases that get out of bed at the end of six weeks; come out with a shortening of one-fourth of an inch, and are found to have increased the shortening by another one-fourth or one-half of an inch. It is remediable. The limb can be drawn down and the original length secured; but, unfortunately, unless we are on our guard, it is liable to occur, and very frequently it is not detected. Some shortening we are responsible for; and that is this kind; but the shortening that occurs in the beginning from the mending of the bone we are not responsible for, at all; and if the patient escapes with not over three-fourths of an inch shortening, he is not going to be essentially lame.

In all the ordinary fractures of the femur, anywhere from an inch or two above the popliteal space to an inch or two below the trochanters, the treatment is the same. In old times it was treatment in the straight position. Two or three centuries ago treatment vibrated back to the double inclined plane. Latterly, it has returned to the straight position; and it is the rule now that all fractures of this kind that I spoke of are treated in the horizontal position, and by extension and counter-extension. Since the use of the weight and pulley, which, by the way, is mentioned far back in the Middle Ages; and since the use of plaster exten-

sion, which was used in 1771; since the re-discovery and re-use, so to speak, of these two methods of treatment, the treatment of fracture of the femur has become very much simplified. When I was a student, it was customary to treat in the straight position; but the counter-extension was made by a perineal strap, and the extension by having a long splint pocketed in the belt; a foot-piece attached, movable by a screw; the foot being fastened to the foot-piece, and the screw being turned, the leg was extended. Then you pulled against the perineum entirely, to the great suffering and annoyance of the patient. Sores occurred. Many of the hospital apparatuses in those days had a padlock to prevent the patient from unbuckling his straps. The result was sloughing heels, sloughing perinei, and general discomfort. This did not occur in all cases; but it was liable to occur in a good many cases. Now, by the use of counter-extension, by raising the foot of the bed, and by the plaster-extension, we have overcome, practically, all these miseries, and have as good results as they had before. One surgeon, I think, has undertaken to treat fractures without extension, by the immediate application of plaster-of-Paris, but the results have not been very successful. You will find in "Hamilton's Surgery" a table of results of treatment by plaster, which is not very encouraging. The trouble is this: The limb is drawn down into place, the plaster-of-Paris applied, and at first all goes on well; but within a few days, when swelling has subsided and the leg begins to shrink, it absorbs more and more as time goes on. It soon lies like a loose substance within a case; and shortening of the fragments takes place inside the plaster, out of sight; and it may result in a union with considerable shortening.

Extension and counter-extension, on the whole, are the

best methods. It is not a part of this course to show the application of apparatus. I only undertake to lay down the rules. Inasmuch as the fracture of the thigh-bone is one of the most serious we have to treat, it seems proper that these rules should be laid down very slowly and exactly with regard to the apparatus ; and that I hope to do plainly now.

Counter-extension, in the first place, by raising the foot of the bed at least four inches. This is useless if you allow the patient a bolster and two or three pillows, because you immediately tip up his body and shoulders on a double inclined plane, and do not get the weight of the thorax and head pulling. The head should literally be lower than the heels, for the first few days until the muscles have got tired out, to make this treatment perfectly successful. Moreover, the bed must be very firm and hard. A bed made of wire or of soft springs is not suitable, unless there are put under it three or four cross-pieces of wood to prevent sagging of the apparatus ; for the upper fragment may be tilted up by the sinking of the apparatus. Everything must be square, straight, horizontal and smooth, and the foot of the bed raised four inches; and if any pillow at all is allowed, an extremely thin one, and one only. The patient must necessarily be forced and instructed to lie on his back, which he is very reluctant to do. He suffers a good deal; has backache and wants to turn; and if he turns he disturbs the fragments. Extension is made by long strips of plaster, water-proof plaster, spread on heavy cloth, which will not soften up under the influence of perspiration or accidental wetting — two long strips, which are carried up to the end of the lower fragment, always above the knee-joint, and then surrounded with circular, or spiral strips enough to keep them in place. Fasten this around a cross-stretcher, to a cord,

which runs over a pulley, and to which is attached a weight. It is of no consequence what the weight is made of, as long as it is a weight of a certain definite amount. A strong man, in the early stages, requires twelve or fifteen pounds' weight to pull down the femoral muscles. Ten to fifteen pounds is a common weight, and five to six for a child. Five to ten for a child or young adult; ten to sixteen for a fully developed and strong person. We must be guided a little by the size of the thigh of the individual, by the power of the muscles, by his weight. Weight is to be put on until the thigh is brought down to a length equal to the other, as determined by careful and repeated measurements. We may not accomplish this the first thing, but ought to accomplish it in twenty-four to seventy-two hours. It is found that, after a few days, the muscles get so tired that they will give out considerably, and the length of the limb can be maintained with a diminished weight. It is questionable, I think, whether it is desirable to have sixteen pounds pulling for six weeks upon a leg. It is conceivable that we may separate the fragments, may delay union in that way. We should allow them some chance to come together, but at first great power has got to be used. When the muscles get tired, we take off several pounds, and go down from sixteen to twelve, or from twelve to nine or ten, according to the amount which was first used.

You must also be extremely careful that friction about the bedstead, friction of the foot pressing against some rod or cross-piece, friction of the heel pressing against the edge of the mattress does not defeat your object in getting perfect extension. It is important that the heel should swing free from the bed, and be separated by a pad in the hollow of the ankle, so that the heel may lie off and not touch. The

heel is the part above all others that does not bear pressure well. In health it is almost wanting in sensitiveness, as you know; but pressed upon, it becomes as tender and aching as a diseased bone; and when it once sloughs, it of course being of a thick and semifibrous and feeble tissue, it repairs very slowly; makes a disastrous ulcer; which is a long while in skinning over, so that the patient can move about; so that ulcerations over the end of the os calcis are to be dreaded. You can see in the skeleton how much of a protuberance this bone makes, and the importance of having this lifted up by a pad.

The next point is to prevent the lower fragment and the knee from rolling out, which they will do if not supported; to avoid eversion; to keep the great toe on an exact line with the inner border of the patella; and in order to do that we have got to immobilize the places where motion can occur.

What are these? The hip-joint, knee-joint, to a less degree the ankle-joint. These three joints must be immobilized; and the foot inverted; the toe kept straight up, and on a line with the inner border of the patella. We accomplish this best by the long outside splint. This is a relic of the old period. It must extend down below the foot, and must be placed on the outside of the limb and fastened so that the limb shall be inverted a little and not allowed to turn out. It is a part of the old apparatus, but does not fulfil the same office as in the old apparatus. In the old apparatus it was the means of carrying on the extension. In the new apparatus it is simply to prevent rotation; and I wish to insist very strongly upon that point; for many people make the mistake of thinking that this is a long board which lies down beside the limb in the bed as a

splint, which is keeping up the extension, and keeping up the length of the limb. It has nothing to do with it. It prevents rotation, and prevents motion of the joints, that is all. In order that it may keep a perfectly vertical position it is useful to have a cross-piece attached to it, so that we have a long piece coming down, and a piece, crossing below, but not touching the foot, to hold the splint upright on its edge. We have to have a belt and pocket to confine it around the body, like a swathe. It can be carried up to the arm-pit, and fastened around the body.

So far, then, we have drawn the leg down, and held it by weight; have prevented rotation, and motion of these three joints. It is also necessary to compress the muscles immediately around the fragments of the broken bone; and this is done by means of four narrow pieces of wood, like shingles, placed above and below and on either side of the thigh, to compress the muscles which are about the fracture. No bandage should be put on the thigh under the splints. That cannot be too strongly insisted upon. The splints should be properly padded. They should be fastened on with three or four inch-wide webbing straps and buckles. In that way you can watch the circulation of the part; see the amount of swelling; tighten or loosen at any time; and the object of these splints is only to keep the parts still. When this is done, that is all. You have got the length by pulley from the foot; counter-extension by the weight of the body; you have got position; compressed the muscles, and held the parts in position; and after two or three days you may begin to take off weight.

How long should this be kept on? About six weeks in an adult. Much less than that, for a broken femur, in a child. At the end of six weeks, take off the entire apparatus; strip

the patient completely; let down the foot; measure to see the length; and gently lifting the ankle and foot, and putting the hand upon the trochanter, rotate to see whether you have union. If you have union, and fair length of the limb, it is very satisfactory; but this union is of the softest possible character; will not bear the weight of the limb; and certainly no moving about. Now extension by the weight and pulley may, perhaps, be given up, as long as the patient remains in bed; but in place of that put on a plaster-of-Paris, or dextrine, or starch, or some firm bandage, which extends from the toes to the groin, and compresses the parts evenly, and holds the united femur in its proper position. After that the patient should lie in bed two weeks longer; then sitting up may be allowed; moving around with crutches without putting the weight of the foot on the ground. Still keep on a light plaster or dextrine bandage for three or four weeks more; and if it shrinks and the leg wastes, as it usually does, it can be cut open, and fastened with external straps so as to make a snug evenly-moulded case for the limb. At the end of three months, it is safe to let the patient put weight upon the limb; but it is six months before he can lift on it and shovel, as with the other leg.

In the upper third of the femur a modification of this treatment is required, on account of the fact that the psoas and iliacus muscles attached to the inner trochanter seize upon the upper fragment and tip it up and out. In order to make the lower fragment match it, we must put the leg in the Nathan Smith splint.

When we come to the breaks of the lower part of the femur we meet a new difficulty. The two heads of the gastrocnemius muscle are strongly inserted into the posterior

part of the femur. The moment the shaft is broken off, they pull on the two condyles and draw the lower fragment directly back into the popliteal space; and occasionally make a laceration of the vein, or an abscess, if not properly treated. Now this requires extension in the same position, but, in addition, a padded ham-splint to go in the popliteal space, to force up this fragment, while extension is kept up in the ordinary way. The result of treating the fracture in this way is generally good.

In all these fractures of the femur we are obliged to keep the knee-joint so long stiff and motionless, in the course of the treatment, that fibrous anchylosis is always the result; and the patient, at the end of three months, goes about with a stiff knee, which he is some time in overcoming. This will, with a little care, cure itself; does not need violent pumping, or friction, or massage. It is very prone to inflammation. I have seen — after fractures, when the limb had got strong and the patient was going about — have seen him put back by injudicious movements of the joint, which brought on synovial accumulation. The patient will overcome the stiffness himself, by natural means. Encourage him to sit on the edge of a chair, and lower his foot-stool an inch a day.

Fracture of the Patella. — The knee-pan almost always breaks transversely, and frequently the lower fragment breaks into two pieces. Unfortunately the fragments are very seldom exactly alike in size, and these peculiarities explain why it is so difficult to get good union between the fragments. If we had a perfectly square break across the middle of the patella we should be able to hold the fragments more firmly and evenly and get better union, but we almost always have to deal with one large frag-

ment and one small fragment, and frequently with one large fragment and two small irregular fragments. You will see at once how much these increase the difficulty of coaptating the parts or of making them unite. This being a sesamoid bone, developed in the tendon, has no great active or reparative power, and is incapable of uniting by bone, unless provoked by some foreign substance. A simple fracture, by wiring, will unite by bone; but if left to the processes of nature it will not unite by bone. The lower fragment is fixed, tied to the tubercle of the tibia by the ligamentum patellæ. The upper fragment is movable, fastened to the quadriceps femoris, and pulled up violently by the contraction of the rectus muscle. This separation usually takes place at once; and when we see a patient with a broken knee-pan, we generally find that considerable separation already exists. If untreated, and the patient is allowed to go about, this increases more and more, until, in one extreme case I saw at the hospital, of a sailor, there were between four and five inches between the two pieces of the patella. You may remember that the vasti muscles are inserted into the sides of the tibia and fibula by very strong extensor tendons, which are flat and fascia-like and firm. They form a sling which lifts the leg, after the attachment of the rectus to the patella is broken off; and they are the salvation of the patient who has broken the patella. This sling becomes very much increased in strength; grasps the knee as the two hands would; and in that way the foot is held with considerable safety, and moves with considerable force.

Fortunately it happens after fracture of the patella that, although union is not by bone, yet a simple separation of the fragments with membranous union is just about as

useful as union by bone. Hamilton lays down the law that separation up to an inch gives as good a limb as close apposition of the fragments, with regard to future utility. In this case the patient is not only dependent upon the membranous union of his broken knee-pan, but also upon the sling of the two vasti extensors, which become enormously thickened.

On the other hand, we have the means, if we succeed in the operation, of provoking bony union by cutting down on the fracture, converting the simple into a compound fracture, washing out antiseptically, drilling the bones, wiring, forcing the wire to hold them in contact a good many weeks, finally untwisting and removing the wire, and then eventually healing up the part, if fortunate, without sepsis, or destructive suppuration in the joint. Whether the good to be gained by this procedure is worth the risk it entails must be left with every patient and surgeon to judge for themselves. I think an important point to be borne in mind is this, that we should never lose sight of the constitution, age and vitality of the patient when we are considering the propriety of subjecting them to any operation of this kind. We have got, on the one hand, the certainty of ligamentous union with fair result to the patient, if he is well taken care of; on the other hand, a better and firmer union, if the patient undergoes a certain risk. Will he keep up nutrition? is he likely to go into the condition of delirium tremens; or to sink in any other way? On the other hand, if we think it more prudent to use the old method, he is pretty sure of getting a fair leg, any way.

The principles of treatment are to treat the leg in the extended position. The patient must not only lie flat upon the bed, but the leg and foot must be raised up from

the bed at a slight incline, in order to relax thoroughly the rectus muscle. The rectus has two heads. One is fastened to the pelvis just above the anterior inferior spine. We cannot relax that head unless we bend the femur on the trunk, and that is the object of lifting the foot a little higher than the bed. The fragments may be drawn together by a plaster, or figure-of-8 bandage; and finally a plaster-of-Paris bandage may be applied to the whole limb; an opening being left through which we can watch the fragments. This treatment cannot be applied at once. The fracture is a break into the knee-joint; and the injury, in consequence, is pouring out blood, and there is leaking into the joint. There is also a large effusion from the synovial sac, and we have a state of acute synovitis and ecchymosis; therefore we cannot apply this treatment at first. You find, at first, the leg cool and the fragments separated, and you say "we can treat this at once," but the next day, you find the synovial sac full of fluid; the fragments wholly separated; the parts extremely tender; the surface black and blue, and risk of destructive suppuration in the joint, if you persist in harsh treatment.

The early treatment of fracture of the patella must be, in almost any case, to put the limb on a ham-splint; place it on pillows on a soft bed; to treat the synovitis for the first few days, sometimes by evaporating lotions, sometimes by cold, sometimes by leeches; and, after this, by more stringent treatment. I suppose this treatment would not apply to the case where you were to cut down and wire it.

The trouble about these fragments is not so much that we cannot draw them together, as that they tilt. Any pressure on the edges tilts up the middle; and the broken surfaces, instead of lying in contact perfectly, rise up, and

it is difficult to control them. Malgaigne's hooks are, no doubt, an excellent means of holding the fragments perfectly in apposition. The plaster; the figure-of-8 bandage; the method known as Sanborn's, which consists in putting two rollers above and below the patella and applying plaster up and down the limb, and twisting it with a stick over the rollers, are also sometimes very good methods of keeping the fragments together. I think we should be reasonably satisfied if we can hold them together so nearly that no more than a quill or pencil can be laid between the fragments while treatment is going on; and if the limb is immobilized you will get good union. That union is liable to stretch, at any time, for four or five months. Hamilton says, after five months, union is strong enough to resist anything. Consequently, in the first place, the primary treatment must be very long, three months, at least; and subsequently to that the patient must wear a ham-splint, with a joint, for two or three months more. I mean a ham-splint so made that, although it has a hinge in the back, it can only bend to a slight degree, and brings up by a catch, so that the patient cannot possibly drop.

What is the consequence if he gets an accidental early bending or fall? Re-separation of the fragments. This happens very often indeed. The patient is going about the wards and begins to feel pretty strong; his crutch slips, and that leg gives out at once; and the fragments are more widely separated than ever. Unfortunately, reunion is much slower and poorer and more imperfect than in the first place; and it is a great disaster to happen, in addition to the loss of time, because he never gets so good a leg as before.

Patient treatment for months. Care afterwards for many months later. Wearing this ham-splint for more than five or six months, perhaps; and finally, the patient will get a very useful limb. It is an annoying accident. For the size of the bone and of the injury, it entails more delay and loss of utility of the limb than the fractures of a great many larger bones.

Fracture of the Tibia. — The tibia never breaks alone, I think, except in consequence of a direct blow. When it is broken alone, the fibula is a splint for it and holds it in place.

The treatment is very simple. A plaster can be put on; and the fibula will hold it in place. There cannot be shortening; and union will take place in four weeks.

Fracture of the Fibula. — When the fibula is broken alone, it gives way about two inches above the ankle-joint, as a rule, where the bone becomes quite thin. It always occurs by the same sort of violence that gives what we call a sprained ankle. When a person has a sprained ankle he steps off of some height and turns the toes in, or the foot into the position of varus. The ordinary sprained ankle consists in tearing some of the ligamentous fibres, and loosening the joint. The same sort of accident, in some patients causes fracture of the fibula. Unfortunately fracture of the fibula one and a half or two inches above the joint is often mistaken for a sprained ankle; and so treated, with disastrous results. The sprained ankle gets better at the end of ten days; but at the end of ten days the broken fibula is just as bad and painful as ever. Some one then makes a more careful examination, and detects the fracture. It is detected by placing the two thumbs on the fibula, and springing the bone up and down, and com-

paring it with the other leg. In the limb where the fibula is broken you have perhaps crepitus and localized pain and tenderness; a little irregularity of the surface of the bone; and it springs up and down, under the thumb, like two pieces of whalebone. People can walk with this fracture. Booth shot Mr. Lincoln and went off with this fracture, and rode two nights; and if he had not had to go through other hardships, probably he would have done very well. People can go about with this fracture, but it will not get well.

Dupuytren's splint is a good one. Apply on the inside of the limb and bandage over. Simple plaster-of-Paris, put on, is sufficient; and with the plaster on, the patient can get on crutches, and move about very soon, without putting weight on the limb.

The essential point in regard to this injury consists in its diagnosis. Its treatment is easy, and its cure certain.

Fracture of the Tibia and Fibula. — Fracture of both bones of the leg almost never takes place on the same level. One is above or below the other. As a rule, the tibia is low down and the fibula higher up. Moreover, fractures of the tibia anywhere between its upper and lower thirds are almost always oblique from before backwards and upwards, so that the upper fragment has a sharp shell of bone which lifts up against the skin. If the fibula is also broken, the gastrocnemius muscle acts as a bow-string on a broken bow, and forces both of the bones upwards against the skin and out of line. The difficulty in fracture of both bones consists in keeping both these oblique fractures down in place. The skin is extremely thin, and liable to be irritated and to slough unless very carefully treated. Great shortening does not take place in fractures of the lower

leg. It is usually not noticed by the patient afterwards; and does not occur to any great degree. Moderate shortening, perhaps, always occurs. It is best detected by setting the patient square on a chair, with the knees at right-angles, feet naked, and toes carefully placed together. In that position we can detect whether one knee is on a higher level than the other.

The difficulty in treatment is principally in getting this oblique fragment of the tibia down in place and keeping it there. Sometimes we can do this with gentle compression and bandage; sometimes by a lateral splint holding the parts. Sometimes we are obliged to raise the heel and the foot in order to draw the lower fragment up into contact with the obstinately riding-up upper sharp piece, which threatens to break through the skin of the leg.

There do exist, occasionally, very irregular and oblique fractures of the tibia which have a split running up the bone besides, in a triangular direction. These are extremely troublesome. They are among the most painful that exist; and the patient suffers from neuralgic pain later. You must warn the patient that such a fracture will repair, in time; but that he will have lameness and pain for a good while afterwards.

Four to six weeks for fracture of both bones of the lower leg; and plaster after that, put on for some time, and crutches. Weight put on the feet slowly afterwards.

Pott's Fracture.—The most troublesome fracture of both bones of the lower leg is Pott's fracture; described by Mr. Pott, who was himself a victim of the accident and who devised means of treating it. It consists of fracture of the fibula at the classical place, one to one and a half inches above the joint; rupture of the internal lateral ligament

alone, or rupture of the internal lateral ligament with breaking off of the tip of the inner malleolus, as well. So that the tibia projects inwards, and the foot is dislocated outwards at an angle from the leg.

Now it is very plain what we want to do in order to get this back into place, and if we can accomplish this it can be successfully treated. The dislocation is to be reduced by carrying the foot in. The foot is to be set at a right-angle to the leg, so that the lower surface of the foot is at a right-angle with the tibia; the great toe on a line with the inner border of the patella. It is desirable, in setting this fracture with dislocation outwards, to carry the great toe a little further inwards than the inner border of the patella; and instead of having the foot dislocated outwards, have it turn a little inwards, in the opposite direction, as if the patient had a commencing varus. We do not expect to maintain that position always; but we exaggerate a little in order to retain enough of the right position when the foot comes out of the splint. There are some cases of this fracture where the parts will not stay in place; where dislocation backwards occurs; where the astragalus pushes out in front of the tibia; and it is in this class of cases that we are to do tenotomy of the tendo-Achillis. Cut that, and the whole thing is in place at once. The proper position is with the great toe a little further in than the inner border of the patella, and the sole of the foot strictly at right angles with the limb. It is best confined with a plaster-of-Paris bandage. The dorsum of the foot and the front of the leg should be left open, so that we can see the position and guard against swelling.

This is a tedious fracture to treat. It takes eight weeks; and you must warn the patient that he will be extremely

fortunate if he gets through without stiffness of the ankle-joint, since he has had dislocation, and fracture into the joint.

I cannot too strongly call your attention to the fact that in treating all fractures of the lower leg it is of the last importance that the foot should be kept up at right angles to the leg. If we allow the foot to droop, the result is that the bones are so much shortened that the patient walks ever afterward in the position of talipes equinus, on the ball of the foot; and cannot get the heel down to the ground; whereas if from the first he is treated in the rectangular position, subsequently there is no trouble.

Fracture of the Os Calcis. — Fracture of the os calcis is rare. It happens from the person stepping off a height and lighting on the arch of the foot. If the os calcis is broken off, you can see what must happen. The tendo-Achillis, all the strong calf muscles of the leg being inserted there, pulls the fragment up on the back of the leg.

In order to approximate the fragments of the bone, we have got to put the leg strictly in the equinus position; drawing the heel up as far as possible with a strap, in order to get the fragments together.

Union generally takes place, and the result is fairly good.

Fractures of the Tarsus. — Fractures of the tarsus are almost always compound, the result of crushing; or if not, they do not occasion much displacement, and readily heal.

Fractures of the Metatarsal Bones. — Fractures of the metatarsal bones, on the other hand, are frequently produced as simple fractures by the fall of timber on the foot; and give rise to the same sort of displacements and deformities that occur in the metacarpal bones of the hand. Fracture of the metatarsal bones corresponds very much to the fracture

of the metacarpal bones. The bones should be held nicely in splints, and carefully padded. If subsequent irregularity in the union occurs, and there is any knob or projection above, or below, or at the side of the metacarpal bones, the patient is sure to feel it. Careful attention must be given to the sitting and adjustment of the bones; and so also with the toes, as with the fingers.

The only point of any importance is this: when you have to treat fractures of the metatarsal bones, the foot does much better upon a large splint, shaped like the leather sole of a shoe, than upon any narrow splint, fitted on any one individual toe; you want a large wooden sole; adjust it with other splints, plaster or what not, in order to compress the parts into shape.

XIII.

DISLOCATIONS.

You recognize a fracture by crepitus and mobility, and by the fact that it will not stay in place after we have drawn it back into position; and, in gross terms, we recognize a dislocation by the fact that there is no crepitus, that it is stiff rather than movable, and that it does stay in place, if it is replaced into its proper position.

When a bone is thrown out of its position by some external violence, it makes no matter what, sometimes by a direct blow, or by a fall, or by a severe strain of the muscles, there are two obstacles which prevent its reduction. One is the painful and rigid contraction of the muscles, which pull upon the bone in its new position, and prevent it from going back; and the other is the ruptured fibres of the capsule and ligaments around the joint. This last impediment must vary a good deal. For instance, in a strictly encapsulated joint like the shoulder, an extremely movable joint, the bone slips out and goes through a rent in the capsule and rests in some new location. On the other hand, when the head of the thigh-bone happens to be thrown out of the acetabulum, it has two powerful tendons, so to call them, which resist reduction. One is the so-called ileo-femoral ligament, or Y ligament, described by Dr. Bigelow, which gets wound around the bone in various directions; and the other is the tendinous portion of the obturator internus muscles, which is more nearly a tendon than a muscle. These two forces

prevent the bone from slipping back into place. Now in old times all these obstacles had to be overcome by direct violence; and hence the use of traction and the pulleys. In a moderate case, the patient was held strongly, and the surgeon and assistants, having put on what was called a clove-hitch on the arm or leg, pulled and pulled until the muscles were tired out, and the ligaments, which were in the way, were ruptured. The fibrous tissue was ruptured, and the bone finally was got back into its place. The more they pulled the harder the muscles resisted. Agony, of course, was inflicted on the patient. The spasmodic contraction grew harder and harder; and it was sometimes a matter of a half-hour to an hour, and sometimes several hours, before the patient's nervous force was finally exhausted, the muscles worn out and the bone got back into place.

The introduction of anæsthetics, besides producing profound sleep and unconsciousness to pain, is also found to relax the muscles just as they are relaxed in death; hence the giving of ether or chloroform to a patient, after they are profoundly narcotized, obviates entirely the muscular resistance, and that great obstacle is out of the way. There still remain the torn capsule, ligaments, fibrous bands, to strongly resist reduction; and these were, until quite recently, overcome by force; and the patient having been etherized, then traction was used. Sometimes even the pulleys were employed with ether to force the fibres apart, and to let the bone spring back into the socket. Latterly, however, it has been found that this resistance also can be overcome without violence, by manipulation, bending, untwisting the opposing fibres, and thereby letting the bone slip back into the socket.

The reduction of dislocations now turns upon two points, —profound anæsthesia, and what is called manipulation,

that is, tipping the bone about so that it will glide back into place, and get out of the folds of fibrous tissue which are embracing it. That marks the great distinction between the treatment of dislocation nowadays and that in former times.

On account of difficulties of diagnosis it not infrequently happens that dislocations are not discovered; and the patient, at first thought to have a blow and sprain, is afterwards found to have a bone out of the socket, weeks or sometimes months, after the injury has been inflicted.

What happens if the bone remains always unreduced? Nature then alters, in the first place, the socket. It is no longer of any use; and it is filled up and changed by the deposits of new plastic material and bone, and becomes smoothed off, in time. Meanwhile the bone rests out of the socket, in some false position, upon another bone, or among the muscles. There nature gradually hollows out a new socket. A rim of bony tissue is built up around the head. A species of false synovial membrane is formed; and what is called a new, or false joint is made, to accommodate the movements of the part. It, of course, is never so good as the original joint; but it is, in many cases, a very fair substitute for it. This is especially true of the shoulder. Now the articulation of the humerus with the scapula can hardly be called a ball-and-socket joint. The head of the humerus plays almost upon a plane surface. There is no socket; and when this bone is thrown out and lodges in a new position under the coracoid, or in the axilla, the head rests in the soft parts, a species of synovial sac is formed, and a very fair subsequent use of the arm is had. On the other hand, when the femur is thrown out, nature forms gradually a new socket and places a bony rim around it, so that with great shorten-

ing and great inversion, the patient still has considerable power of moving the limb. Seeing that nature does this, it is a question whether we should attempt the reduction of dislocations after a considerable time has elapsed from the first injury. This question turns upon several points. We know, in the first place, that if we do not touch them, nature will patch up the injury to a certain degree, and that the patient will get a more or less useful limb. The question of attempting to reduce an old dislocation turns then upon two important points. One is whether, if we succeed, we can give a much better limb than nature would make if it were left alone; and the other is, what additional risk we shall put the patient and his limb in, if we attempt a forced reduction after a considerable length of time.

No exact rule, I think, can be laid down for the proper conduct of the surgeon in such cases. It must depend upon the joint; upon the individual patient; upon his age; upon his idiosyncrasies; and, the chief factor of all, upon the length of time that has elapsed since the injury was first received. It is obviously easier to make an attempt to break up adhesions if the humerus is thrown out of the socket, than it is in the case of the thigh; consequently, successful attempts at reduction after old dislocations of the shoulder-joint are much more numerous than after dislocations of the hip. Unless the femur can be put back pretty soon after the injury is received, it becomes almost impossible to do it; and the question arises then, whether the division of the muscles and fascia, or section of the neck of the bone, may not be preferable to attempting reduction of the head of the femur to its natural place, by force.

What are the risks that we run in trying to reduce, at a

late day after the injury? In old persons, breaking the bone. That is very common. Breaking the humerus, or the neck of the thigh-bone, if we attempt to reduce them. Then we have converted a dislocation into a fracture of the neck; which perhaps would not unite if we tried to make it; which we should better leave, and let it become a new false joint, just as it does in fracture of the neck in very old people, of itself.

More important than this is the injury, especially in the upper extremity, which is liable to be inflicted on the vessels and nerves which are pressing against the head of the bone when thrown out of the socket. Of course, in the normal state the large veins, nerves, artery, pass down a little out of the way of the bone; but let that be thrown out, and vessels and nerves are compressed. Neuralgic pain is the consequence, and great swelling of the arm. If the bone remains in this position, nature accommodates herself to it, and the pain gradually goes away and the swelling subsides; but if, in the case of an old dislocation, we etherize the patient, seize the arm, and attempt to get it back into place, it can only be done by first circumducting it in various directions with a good deal of force, and then trying to pry it up into the socket. By so doing we run a great risk of injuring the veins and nerves, and producing a neuritis, if nothing more; of not very infrequently rupturing the large axillary vein; and occasionally plugging, if not tearing, the artery. It is quite common, in attempting to reduce an old dislocation of the shoulder, to have the pulse lost at the wrist, and to have great swelling of the part below for some days after the reduction has been successfully accomplished; and if it is not easily and successfully accomplished, and if a long period of circumduction and breaking up has to

be gone through before the attempt is desisted from, occasionally the vessels are so far injured that they fail to recover; the limb mortifies; amputation at the shoulder-joint is the only resort to save the patient's life; and the result is much more disastrous than if he were left alone. I do not mean to say that we should not attempt to reduce any old dislocation. We should take these things into careful account; the number of weeks it has been out; the age of the individual; how much nature will accomplish in such a joint if left alone; and the chances of injuring vital parts if reduction is attempted. The humerus has been put into place, many times, after sixty and seventy days; after eighty or ninety days it usually fails; and in old people the attempt has frequently sacrificed the arm. The femur, as a rule, will not stand attempts after so long a period; and unless dislocation of the femur is reduced within the first month or six weeks, I do not think there is very much prospect of getting it back into position. Of course, there are exceptional cases, where you read of brilliant success at an unexpectedly late period; but bear in mind that all these exceptional cases merely illustrate, and prove by their rarity, the more common rule, that the bone cannot be got back easily and safely after a certain length of time.

So to review, very briefly, we have these important points which govern every dislocation: We now can overcome muscular resistance by ether, and overcome ligamentous resistance by manipulation. We may attempt reduction of old dislocations. If we fail, we may still console ourselves with the belief, that a tolerable joint will be got by the efforts of nature, with the bone in its new position.

Dislocation of the Lower Jaw. — The first dislocation we shall speak of is of the lower jaw. Partial dislocation

of the lower jaw forward at the eminentia articularis is a very common occurrence, and the bone snaps back itself. This is the case with many young subjects, especially females, where partial dislocation of one side takes place with a creaking noise, during gaping, or opening the mouth wide. The patient rubs the jaw a little, and the bone snaps back into place. Under profound anæsthesia we can, with the thumbs behind the angle of the jaw, partially dislocate the bone forward upon the eminentia articularis, and throw forward with it the glottis, and prevent the swallowing of the tongue.

Complete dislocation of the jaw forward over the eminentia articularis, up into the temporal fossa, puts the mouth into a peculiar and characteristic position — wide open, and the chin thrown out a considerable distance beyond the upper jaw. Dislocation of this kind on one side, of course, makes a peculiar deformity. The common thing is to have both thrown out.

Reduction is easy. The chief thing to guard against is the mutilation of the surgeon's fingers in making the reduction. It can be reduced by putting both thumbs inside of the jaw, pressing the ramus down and back, and it will slip up into place. It is thrown out over the eminentia articularis, and you push it down and it will glide back into place. Previous to doing this some firm substance should be put into the mouth so that the jaw cannot shut on the thumb of the surgeon while making this manipulation; or the fingers can be guarded with something to prevent cutting by the teeth. Perhaps it is not worth while to delay longer on this. It is not common. It is almost impossible to fail to recognize it. It is easy of reduction.

Dislocation of the Clavicle. — Dislocation of the clavicle is rare. If it occurs, the common form is a dislocation of the acromial end upwards, with rupture of the ligaments. A rarer occurrence is dislocation of the sternal end of the collar-bone. All these dislocations are easy to recognize, can hardly help being seen. It is very difficult to press the bone back into place, and almost impossible to keep it there. The only one of consequence, as regards endangering life, is dislocation of the clavicle backwards behind the sternum, when it presses on the pneumogastric and on the trachea, and leads to dyspnœa and to severe symptoms. That accident is extremely rare. Something must be done to relieve it; and the most practical thing would seem to be to divide the fibres of the sterno-mastoid muscle subcutaneously, and endeavor to press the bone back into place. Failing of that, I suppose a resection of the end of the collar-bone, with antiseptic measures, would be proper and justifiable.

Usually dislocations of the sternal end are upward and forward, and do not entail any injury to the parts in the throat, but entail deformity, and subsequent bad use of the arm.

We try to force the bone and keep it back in place by strapping and pads, and especially by having the shoulder drawn back as far as possible, to draw the collar-bone out. Treatment is to be continued four to six weeks.

The ordinary dislocation of the collar-bone is of the acromial end upwards. The ligaments are ruptured, and the bone pulled up by the fibres of the trapezius muscle. And we find, on looking at such a patient from behind, a rigid line along the fibres of the trapezius, which is rather diagnostic of dislocation; and a projection, which, of course,

would have to be diagnosticated from a fracture of the acromion process with drooping of the shoulder.

The treatment is about the same, whether it be fracture of the acromion process, or dislocation of the collar-bone. Crowd the arm well up, and strap the acromion down, and hold it in position four to six weeks. The results are fair. A little deformity frequently remains. The arm, however, becomes good and useful.

The other dislocations of the acromial end are rare. It is not worth while to waste much time on them. It may be dislocated a little forwards or backwards. The treatment would be about the same. Force the shoulder back ; pad ; and force the collar-bone down into place.

Dislocations of the Humerus. — Dislocations of the humerus are generally described as four in number. One is so extremely rare that we can eliminate it in speaking of treatment, and that is where the bone is thrown out of the socket and lodges back on the scapula. You may never see such a case. When it occurs the diagnosis is very easy.

The ordinary dislocation of the humerus is forward under the coracoid process, what is called subcoracoid. The bone comes out of its flat socket and slips forward, and a little downward, under the coracoid process, and rests between the coracoid and the ribs.

The other common dislocation is when the bone drops straight down and rests in the axilla.

Now in either of these two common forms, the roundness of the shoulder is lost. The natural shape of the deltoid muscle, instead of being rounded out, looks flat. If we seize the shoulder in this way, we are conscious of a vacancy, an empty space under the acromion process. We

can compress the muscular fibres as we cannot do on the sound side. The arm appears to be slightly lengthened. Motion is lost. If we place the hand on the opposite shoulder and have it held, we cannot bring the elbow down in contact with the ribs if the bone is out of the socket. We may force it down temporarily, and it springs up again. We can compare that with the sound side; and find that it is perfectly easy to have that laid down in its normal position. The loss of roundness of the shoulder; loss of mobility; loss of function, of course; and inability to approximate the elbow to the side, are the important points. In addition to this, if dislocation of the humerus happens to be downwards into the axilla, if we raise the arm from the side, and pass the hand well up into the axilla, we always find the head of the bone there. If there is any doubt, we can compare with the sound side; and can hardly fail to find projection downwards of the head of the bone. If there is subcoracoid dislocation, we can feel the head of the bone under the fibres of the pectoral muscles.

Obstinate abduction of the arm from the side; loss of motion, and disability, are common to the two forms of dislocation.

The patient having been etherized, and the muscles all relaxed, the obstacles to reduction would appear to be to get the head back through the capsule, through the rent by which it went out. In many cases this appears to be very easy indeed. Ether having been given, with a little traction and manipulation, the bone frequently slips back into place. Various manœuvres are contrived for that purpose. One secret in reducing dislocations of the shoulder is to render the scapula immovable; because if that

moves with the humerus we lose all power of reducing the head. The scapula is rendered immovable by a strong bandage put around it and held by an assistant with great firmness. If that is not sufficient, additional immobility can be gained by applying some heavy adhesive plaster over the scapula, and drawing on the ends of that. The scapula secured; the arm is got back into place by various manœuvres. If, as is usually the case, it is in the axilla, then if the arm can be drawn down and the head forced up from below, it is easily pried into place. That is done by the surgeon's foot in the axilla, who sits beside the patient, draws upon the arm, and presses the head of the bone back into the socket. If this fails, having the scapula held, and drawing firmly off in the longitudinal direction frequently gets it into place If this fails, the patient is etherized and placed upon the floor, and the foot of the surgeon is placed upon the shoulder, and the arm seized and drawn directly upwards, and that frequently succeeds.

Then there is the method called Kocher's by which the arm is held firmly in to the side, and the bone rotated out and lifted into the socket. There is rarely a failure in one of these methods. Sometimes one succeeds a little better than the other; but the simpler one of pressing with the foot in the axilla is frequently successful. We are entirely sure that the bone goes in by hearing it, or feeling it, — by hearing a distinct snap when it goes in.

This is all the treatment. The trouble is to prevent it from dropping out. The capsule has been badly lacerated, and the joint is really no joint at all. It drops out very easily unless taken care of. The motion by which it will drop out is in lifting the elbow away from the side; hence,

in the subsequent treatment, we must take great care to keep the elbow in to the side by a body bandage, and to put the forearm in a sling. With the humerus approximated to the ribs and the elbow supported, it is impossible for the head to drop out. That should be continued about a week, and then the arm put in a sling only. In some cases, where there have been repeated dislocations, it is a good plan to fasten an elastic around the arm and to the side, which prevents outward movement for many weeks.

It is a long while before the adult recovers full use of the shoulder. In lifting the arm to the head, or in making the motion of trying to put on a coat, it is long before either can be done without pain.

All dislocations are accompanied by great swelling, more so than fractures; consequently, after the injury is reduced, subsequent treatment should be very gentle. No very hard bandages should be put on. Frequently, evaporating lotions or leeches may be called for, and tight bandaging will not be borne. After the part has recovered, and the patient is left to himself, the use of the arm may be much improved by gentle manipulations, massage, liniments, warmth, —agents of that class.

What we have to dread in any old person after dislocation is the chronic rheumatic arthritis that may be set up in the joint; and we cannot always predict that they may not afterwards have some stiffness or roughness of the joint, although the part may be perfectly restored to place.

Dislocations of the Elbow. — The elbow is a complicated joint, and the great point is this, when it is dislocated and you treat it, to be sure that both bones are back into place. It is very easy to appreciate, if the ulna is out, when it comes back into place with quite a loud snap. The joint is locked

again, and the motions of flexion are restored and the symmetry of the arm; but the head of the radius is a small bone, its motions are peculiar, and it may not be perfectly reduced; and if it is overlooked, it is disastrous to the future use of the joint.

The books make a great many divisions of dislocation of the elbow. They are not, however, of very much importance. They are called backwards and inwards, and backwards and outwards, etc., but, practically, they are all backwards, and more or less turned from side to side. The whole treatment consists in getting both bones back into position. The patient having been etherized, we go through the motions of having the fulcrum applied at the bend of the elbow, the arm steadily held, and the forearm first extended, and then brought up forward; and then, if we have restored the ulna, we may carefully look for the position of the head of the radius, and endeavor, by prying, pronation, supination, flexing and extending, to get that back into its normal position.

The diagnosis of dislocations of the elbow, of course, turns on the relative position of the three points, the two condyles and the olecranon, that we mentioned in speaking of fractures just above the elbow-joint. If they are in their normal position compared with the other arm, it cannot be dislocation; it is probably a fracture. If the ulna is drawn far out of its normal position as regards the condyles, then it is a dislocation. Of course the final test is in getting the arm in place and seeing whether it will stay. If it will, it is dislocation without fracture.

In all healthy subjects, and especially in young subjects, dislocation of the elbow is not followed by impaired use of the joint. It takes time, but motion is generally perfectly

restored. It is not desirable to keep splints on too long. I think that is quite an important point. You must see in a joint so firmly locked together, that if it is once put back into place it is not very likely to get out again, and a confinement for a moderate length of time is all that is necessary; and after the synovitis is subdued, it is better that the patient should begin moderately the use of the arm. Cases have occurred, occasionally, in which, through fear of using the arm too soon, it has been tied up too long, and the consequence was that a simple synovitis has been converted into fibrous anchylosis; and then both physician and patient may be at a loss to know whether there had been a fracture or not; whether it would be safe to move the arm, and whether it would ever recover its mobility.

Very careful diagnosis from fracture. Very careful reduction of both bones back to their perfect position; then a short treatment afterwards, with the arm on the internal angular splint, and a sling; the back of arm uncovered, so that we can apply evaporating lotions or leeches; no tight bandaging being used.

Dislocation of the Wrist. — Dislocation of the wrist is almost unknown. Few people have ever seen one. It is accompanied with fracture, — fracture of the radius. Fracture of the radius and dislocation of the wrist, or Colles's fracture, is common. Dislocation of the wrist pure and simple is extremely rare. Of course, I would not include in this statement those cases of compound fracture where, from severe blows and laceration, individual bones of the wrist may be thrown out of place; but dislocation of one row of carpal bones from the other, or of a row of carpal bones from the articulation with the radius, is extremely rare.

Treatment would be obvious and simple. Draw it back

into place and confine it on splints, and gradually use passive motion.

Dislocation of the Thumb. — Dislocation of the thumb, at the joint where the phalanx joins the metacarpal bone, is recognized as an extremely annoying dislocation. It is complicated by the fact that there are two little sesamoid bones; and when the thumb is thrown out, the phalanx goes down into the palm and gets entangled in the tendons. Make a fulcrum of your own left thumb under the joint, then pull the patient's thumb directly forwards, and then force it back beyond a right angle. It is difficult of reduction, and in some cases requires subcutaneous section of some of the fibres. It must never be allowed to remain out of place, because it does not give a good result in its false position; and, rather than leave it, we should divide the tendons, or even resect a portion of the bone and push it back into its place, and treat it afterwards as an excision, rather than leave it in a false position, where the thumb is practically useless and painful.

Dislocation of the fingers can be reduced by extension and prying backwards.

Dislocations of the Hip. — They are four, of which one is excessively rare. Two are the common ones. These two which are common are merely modifications of each other. The head of the bone may go out of the socket and directly upwards and backwards upon the dorsum of the ilium, in which case it is called a dislocation on the dorsum. As a modification of that, it may not go up quite so far, may slip out and drop a little lower down into the sciatic notch. Dislocation into the sciatic notch and dislocation on the dorsum are practically the same thing, except in the amount of shortening. On the other hand, it may drop out and go

directly down into the thyroid foramen, in which case the limb is a good deal lengthened instead of shortened. In very rare and exceptional cases it is thrown out and goes up upon the pubes, and rests either near the anterior spine, or upon the pubes itself. That, however, is excessively rare.

The ordinary dislocation in a strong person, who receives a violent injury, is dislocation upon the dorsum. Now this is so marked in its symptoms that it should hardly be overlooked. The limb is shortened from one and a half to two and a half inches, at once. There is not gradual shortening. Obstinate inversion of the foot to an extreme degree takes place, and the patient cannot in any degree turn it out. We have somewhat the characteristic appearance of a patient with old hip disease and dislocation on the dorsum, which you are familiar with in that disease. If the patient is thin you may feel the head of the bone upon the dorsum by manipulation and examination; but if the patient is very fat and large, it is difficult to feel it under such a dense mass. On the other hand, we have two to two and a half inches of shortening, extreme inversion, total loss of motion about the part, and the history of a violent injury. This injury has to be of a peculiar character; and the blow to knock the bone out usually has to be received on the back of the trochanter, in some way, so that the moment the bone is knocked out and passes over the edge of the socket, the muscles seize it; and in ordinary cases pull it directly up; and in less violent cases pull it back; and, in exceptional cases where the blow is received from above downwards on the trochanter, it is conceivable that it may fall directly down into the thyroid foramen.

Great weights and heavy bodies striking the nates and side of the trochanter from behind are the usual causes of

dislocation. The falling of timbers is a cause. I remember one case in which the cause was the falling of a sign from a building. The caving-in of earth occasionally, though that is more apt to make a crushing of the pelvis. If the bone is thrown out of the socket into the sciatic notch, the shortening is about one-half as great; the inversion is just the same; but the foot is turned over the toes of the opposite foot, instead of over the dorsum. Total loss of function, and the other signs, are the same.

If, by any chance, the bone is knocked down into the thyroid foramen, it is lengthened and turned outwards and partially flexed, and is very characteristic in its appearance. If thrown up upon the pubes, we have shortening, but the toes usually turned more or less outwards, and partial flexion and abduction occur.

Of course, profound etherization is the first measure. Then the patient had best be treated on the floor, or some firm place, low down, where the surgeon can stand over him. A thin mattress or blanket spread on the floor is sufficient. It is essential here, in manipulating to reduce the dislocation, that the pelvis be held still; just as in trying to reduce a dislocation of the humerus, the scapula should be held still. This is to be done by an assistant kneeling and compressing the rim of the pelvis firmly on both sides, while the surgeon makes his manœuvres. The pathological phenomena of dislocation upon the dorsum, or into the sciatic notch, are about the same. The muscles are relaxed by ether; but the Y-shaped ligament is wound about the head of the bone, and the bone will not go back until it is relaxed and unwound; hence bend the thigh gently upwards and turn it in towards the abdomen, and then the surgeon takes the lower leg as a fulcrum, and rotates the head out, and lifts it into place.

This generally succeeds the second time, if not the first. Flex, adduct, rotate and lift is the brief rule.

It occasionally happens, to the annoyance of the operator, that in reducing a dislocation upon the dorsum he fails, unlocks the ligament, gets the bone almost back into place, but instead of gliding into the socket it then slips down, and he has converted a dislocation upon the dorsum into a dislocation in the sciatic notch. In that case he has to repeat his manœuvres, and lift more forcibly over the edge of the socket.

In the dislocation into the thyroid foramen, the reverse manœuvre is to be brought about to unwind the ligament and get the bone to slip back into place. A great deal of time might be spent in illustrating this to you; but it is done so much better and more perfectly in Dr. Bigelow's monograph on the subject, that I advise you to look at his photographs, and the position of the ligaments, and the manœuvres.[1]

Dislocation of the hip is rare. It is of immense importance to recognize it, and to reduce it within the first few hours after the injury; there are two common forms, dislocation into the sciatic notch and upon the dorsum, easily recognized by their peculiar deformity. Ether gives immense assistance in the reduction; and these manœuvres never, I think, fail of success in getting the bone back.

The subsequent treatment is important. In order to prevent the bone from slipping out again, everything being badly lacerated, it is best to make a splint of the other leg; and the knees should be firmly bandaged together, and the patient kept on his back. The patient should be kept in bed two or three weeks, before he is trusted to move the leg out. It will be swollen and pain-

[1] See also Aliss's new theories of the position of the sciatic nerve, etc.

ful; and it will take a good deal of time before he will recover the utility of the part. When he has partially recovered, rubbing, massage, etc., may be used. Here, again, in the elderly person, we may have to treat chronic rheumatic arthritis; but, on the other hand, it is fair to say that dislocation of the hip in the old person is not common at all; for the injury, if received, is almost sure to break off the neck of the femur, instead of putting the head of the bone out. Dislocations of the hip are most common in young persons; and in very powerful vigorous men, men in the prime of life, who receive violent injuries.

Dislocation of the Knee. — Dislocation of the knee is almost unknown, excessively rare. Pathologically it is common; but as a traumatic injury, unless accompanied by compound wounds, opening into the joint, or by breaking of the bone, it is extremely rare.

The semilunar cartilage, which is fastened on the head of the tibia and deepens the socket for each condyle, is occasionally displaced, with very serious consequences; and it is best, perhaps, to allude to that a little more at length. The patient feels something slip about the knee; tries to manipulate it and get it back into place, and finds he can do everything except straightening. In addition to that he may notice a little thickening or projection just at the line of the joint. It is a displaced semilunar cartilage. It is pushed out over the edge of the tibia and caught in the joint, so to speak. If not recognized, it stays there. It is practically incurable. Nature accommodates herself to the new condition; and the patient is left with a partial stiffness of the knee, and inability to make perfect extension.

It is important to be recognized; and can be readily

cured, if recognized. The patient should be thoroughly etherized; the leg flexed far back, and snapped back into place with extension; the semilunar cartilage, in the large percentage of cases, will slip back into place. Then keep the limb perfectly straight on a ham-splint; and later, begin to use passive motion to restore the joint. It is a quite common accident, and requires care in its treatment.

Dislocation of the Ankle. — The ankle can hardly be dislocated without fracture of one, or the other, of the sides of the mortise which hold it in. Fracture of the fibula, with rupture of the internal lateral ligament, makes dislocation outwards; and the treatment to reduce the fracture, and set the parts, reduces the dislocation.

Dislocation of the Astragalus. — Occasionally the astragalus, which lies between the tibia and os calcis, is knocked out of its position. You can see that it must be a very peculiar injury to do it. Usually, the patient falls from a height, and alights upon the edge of something like a brick or stone, and strikes in the arch of the foot. In that way, occasionally, the astragalus is pried out of place. The important point to speak of in this connection is not the diagnosis. That is very easy, for the parts are superficial. By manipulation, we find that there is no crepitus and no fracture. The important point to speak of is the excessive difficulty of reducing this; and the disastrous effects, if left unreduced. So that after the patient has been etherized and attempts at reduction fail, it is considered better to excise the bone, rather than leave it in its false position. Possibly, cutting down to excise it, and dividing some fibres, may enable us to slip it back into place. But if that cannot be done, it had better be excised, and the cavity allowed to fill up; and with a

shortened leg and a shortened foot, the patient will usually get along well. On the other hand, if the bone is left out of position and attempts at reduction fail — I have seen several cases — and, in fact, the universal testimony of surgeons is, that you have a very useless foot, and also a very painful foot. The patient walks lame, and with extreme difficulty. He is liable to ulcerations, and necrosis of the bone; has not motion of the joint, of course; and is crippled worse, almost, than with amputation of the foot. So that in this rare injury it is better to etherize; then to manipulate; then to make a few cautious incisions, and subcutaneously to divide some of the apparently resisting parts. If those things fail, it is wiser to really excise the bone than leave it in its false position.

A word more that I did not mention under fractures. You must be very careful not to mistake a fracture of the surgical neck of the humerus for dislocation. That mistake has been made a good many times. You may judge how disastrous it would be to go through the motions to reduce a dislocation, and apply force to a fracture, when there was really no dislocation at all. It all turns upon this, of course, whether the injury is below the head of the bone in the neck, or whether there is absolutely a vacancy between the acromion process and the head of the bone. That point settled, the rest of the diagnosis becomes easy.

It is hardly worth while to take up time by considering the extremely rare cases where fracture and dislocation coexist. There are such cases. When recognized, the treatment is, of course, extremely difficult. We are usually advised to endeavor to put the fractured parts into position, and to allow time for union; and then make a

cautious attempt to get the head of the bone back into place in the socket. It is obviously impossible to do this until we have some leverage and fulcrum on which we can push back. A very important question is, sometimes, whether it would not be wiser to excise the head of the bone, and leave the patient with an excised false joint, rather than to risk the loss of mobility which we shall get by having a fracture united, and the head of the bone lying out of the socket.[1]

[1] The head has been reduced, since this was written, by making a very small opening, and lifting or prying the bone into the socket. The author has been fortunate enough to reduce one, in a young subject, by manipulation, without any operation.

XIV.

FROST-BITE AND BURNS.

We are all quite familiar with the phenomena and appearances of simple exposure to cold. The first effect produced upon the surface is to drive the blood away from it. The part becomes very white; and then, if the exposure to cold is only brief, reaction takes place promptly. The exposed surface becomes very red and congested; burns; glows; tingles; if exposed a little longer is the seat of intense pain from the returning circulation.

These phenomena, on a small scale, on the surface of the body are due to shrinking of the vessels from the stimulus of the cold. The capillary vessels shrink. The blood recedes. The surface is cooled down. It grows pale. When the cold is removed, the vessels dilate again. The blood returns. The pendulum swings a little further back than the normal limit. Congestion takes place. The skin becomes red and hot; and this sudden afflux of blood is accompanied by pain.

If a large portion of the body is exposed to intense cold for some time, then it follows that a very large portion of the superficial blood must be driven in on the internal organs; and excessive congestion of all the large vessels, and the circulation in the viscera, take place. This before long affects the brain so that death from cold takes place in a state of coma; stupor being produced by great congestion

of the brain; and, if pushed far enough, by serous effusion. We are all familiar with the stories of those who, long exposed to cold, soon give up and desire to rest. They cease to suffer, after a little while, and sink to sleep. It is impossible to resist the inclination to slumber, they lie down and sleep, and die in a state of coma. That is the general effect on the internal organs when the whole surface is exposed.

Now if, on the other hand, the person has only one member exposed to cold, as a foot or a hand, and the cold is not intense enough and long enough to chill the whole body, then that portion which is directly exposed becomes, as it is called, "frozen." In that case the driving away of the blood from the surface continues so long that it does not return promptly; and alteration also is said to take place in the blood corpuscles themselves, so that they disintegrate. In this case the limb is incapable of repair; and although the part may be again exposed to warmth, and every effort made to produce a return of circulation, yet it sloughs; mortifies; spontaneous amputation takes place; and nature makes a cure by granulation, after the process of ulceration.

In imperfect freezings, where a part is chilled, it is capable of recovery. Where it is chilled so far that it is partially frozen, it is capable of recovery. The circulation returns, and with such violence that the danger subsequently is not in a want of return of the circulation, but in its too rapid return. The part becomes congested too rapidly by the returning blood; hence the familiar rule, after a part has been exposed to cold a long time, that it is not safe to warm it too rapidly; and, as it underwent its starvation of blood, so to speak, by the influence of cold slowly, so you must allow the current to come back slowly,

if you want to avoid the next consequence, which is sure to ensue, if it comes back rapidly; and that consequence is intense congestion and inflammation of the part. The danger then of a universal freezing is death from coma and stupor. The danger from a very deep freezing is that the blood will never get back. The corpuscles are altered, and the part dies. The danger of a moderate freezing is that there may be a too rapid reaction and return of the blood. This acts in this way: The part is partially frozen; it is chilled and the blood driven away. The patient goes to the fire or exposes himself to heat. Intense pain and redness is produced; œdema; effusion of blood; loosening off of the cuticle; true inflammatory processes, which end in mortification, suppuration, ulceration, a line of demarcation, and slow repair afterwards.

These modes of injury indicate to us, of course, the modes of treatment; that, if the part is exposed to cold long, the most prudent course is to bring it back to warmth slowly. Apply ice-water, apply snow, and keep it away from heat. Subsequently, when it begins to recover, put on evaporating lotions containing substances like ether, or alcohol, or vinegar, and hold the reaction back. If it can be forced back and allowed to come on in an hour or two, instead of instantly, then the part frequently recovers with a partial inflammation. A partial inflammation causes death of the skin usually; and that gives rise to a very troublesome series of phenomena, but these are not dangerous. Moderate frost-bite if it has been successfully treated always ends in some death of the skin. This is shown by blistering off of the surface, by the occurrence of subacute eczema, which very frequently follows. That is especially true of moderately frozen ears;

in which the ear afterwards becomes the seat of eczematous inflammation for several weeks before it finally recovers.

The same is true of the nose and face and other exposed parts. So on the hands the skin of the fingers may peel off, and the nails may be loosened and some of them drop off, without absolutely freezing through the finger.

Exposure to cold; reaction to be delayed; that is the rule of treatment. Exposed to severe cold with tendency to torpor, the safety of the individual consists in being roused and shaken and driven about and forced to exert himself to avoid the peril of death.

The spontaneous amputations and sloughings which come on after frost-bites affect most commonly the parts most distant from the centre of the body; the fingers and toes. We see it occasionally occur in this climate on land; and quite frequently in sailors who get the hands and feet frost-bitten by the combined action of the salt-water and cold and exposure. These cases are frequently brought to us for treatment in the state of moist gangrene; rapid inflammation followed by gangrene. It is always of the moist variety. It is offensive, soft, sloughing, black, with a distinct line of demarcation forming. It is injudicious to interfere until the line of demarcation has fully formed. It is sometimes questionable whether it is worth while to interfere at all until spontaneous amputation has been pretty well performed; then we can judge whether we can get along with the protruding stump, or whether it is necessary to make a primary amputation back of the injury, and get sound flaps. Whether we do this depends a good deal on the extent of the frost-bite and the location of the part. For instance, it is extremely important to preserve a thumb as long as possible; and, if we can get off by shortening a little piece of bone and have

it recover by granulation, it is better than to amputate high up.

So that in some of these cases it is wiser to wait until spontaneous amputation has taken place down to the bone, then to press back the granulations, scrape them back with the periosteum scraper, saw off the bones high up in the bleeding tissues, allow the granulations to come back over them, and allow the natural processes to go on. In that way we sometimes save important parts.

BURNS AND SCALDS.

Perhaps it has not occurred to you that these are the most frequently fatal and numerous accidents of civil life; and also this other point, which is worth remembering, that more than three-fourths of all the burns and scalds occur in young children. It is natural that it should be so. They are the most careless and most exposed. They go the most about stoves and lamps with their short and light clothing. They are unable to protect themselves after they are burnt. They are much more likely to have a serious burn than an adult because the first impulse of the child on being afire is to throw open the mouth and shriek, and inhale the flame or gas; which they frequently do with fatal result. The shock, also, to these young subjects when burnt is more severe and more fatal than it is with grown persons.

Scalds are not nearly so severe as burns. Burns are produced by fire; scalds by heated fluids, or steam. The species of burns produced, however, by the melting of substances which are denser than water, as for instance, molten lead or molten iron, anything of that kind, are more penetrating and more deep than the burns produced by simple fire, whether of wood or coal. The burns produced by heated metals are

the deepest and most severe; the burns produced by fire are the next; the true scalds produced by fluids and gases are much less so. It is rare that a scald, so-called, goes far into the true skin and deeper tissues; but scalds mostly belong to the set of burns which are, what is termed, of the first class. The French authors have divided burns into six classes; but that is quite a needless minuteness of subdivision. Dividing them into three classes is quite sufficient; and practically only two of these are what we have much to do with.

The first is that which destroys the epidermis and does not penetrate the true skin.

The second destroys the epidermis and goes through the true skin, to a greater or less depth, into the cellular tissue or muscles.

The third class are those which go through the muscles, and go down and perhaps even char the bone.

A person, for example, who is epileptic or drunk, and who falls into the fire, or onto a hot stove, may lie unconscious, and have the limb deeply charred, or the third form of burn. The electric-current and the electric-wire burns are always of the third class, if it is in contact long enough with the tissues. The linemen who repair the wires and get burnt are occasionlly brought to the hospital; are occasionally burned in the hand from catching hold of the wires; and the wire burns down through the mass of the adductor muscles and burns the bones themselves. That is quite a common accident from the electric current. A similar sort of burn is produced by a different cause, among the workers in iron; in blasting furnaces, especially in the handling of long rails, that are drawn out of the furnaces in a bright red state, previous to being hammered into shape.

These burns almost invariably extend down to the bone; and so do the burns from the electric current. On the other hand, the patient who is scalded by hot water or steam has the epidermis peeled off, but the true skin is not affected.

The first class of burns does not scar; the second class of burns does; the third produces deep mutilations.

There are three or four things which seem to influence very much the prognosis with regard to a moderately severe burn. The first is the age of the patient. The next is the location of the burn, and the next is the extent of the burn; the extent more than the depth, and for this reason: the shock inflicted upon the system by a scald or a burn is due to the rapid burning off of the sensative nerves which supply the skin. The skin, being the organ of touch, is enormously endowed with nerves. The filaments terminate there; and they are the organs of a very acute sensibility. A burn chars off the surface; inflicts shock and intense pain; and destroys their function. Now the more skin that is burned the greater the shock. The shock is greater over the larger extent of skin, in a burn of that kind, then in the deep burn which goes far into the tissues toward the bone. This is familiar in regard to the pain of surgical operations. The patient suffers intensely while the skin is being cut; much less when the muscles or deeper tissues are being divided. The shock of the burn depends upon the amount of skin involved; and therefore it is that the extent of a burn is of more consequence in the prognosis of the patient than the depth of it.

The location also is important. The most dangerous place to be burned is the front wall of the abdomen; the next, about the chest, and third, about the scalp. The limbs, much less danger.

The age of the patient you may reasonably suppose would make a good deal of difference in the prognosis, as it would in any class of injuries. Repair is more difficult in the old than in the young, as would naturally be supposed to be the case.

The effect of burning off the skin, or flaying the patient, so to speak, over a considerable surface, say a foot square or more, the effect of burning off so large a surface is certainly to inflict a most terrible shock to the nervous system from the pain produced by the sensitive nervous filaments, hundreds of which are destroyed, and also to produce very serious consequences on the internal organs of the body by the loss of the skin; the interruption of the functions of the skin as an excreting organ. A large burn produces in the internal organs precisely analogous changes to those produced by that acute inflammation of the skin with dislocation which we call scarlet fever. The subsequent consequences are very similar. In consequence of the loss of function of the skin, the power of perspiration and excretion is lost. The excreting organs in the interior of the body have then to do all this additional work. The consequence is congestion of the kidneys to a very marked degree; congestion of the mucous membrane of the alimentary canal also in large burns; and in severe burns there will be very likely albuminuria, and ulcerations in the mucous membrane of the bowels. It, of course, would also be probable, and is the case, that in severe burns about the face and scalp the delicate structures inside the skull are liable to be congested, and meningitis, or serous effusion is liable to follow within the head itself. In addition to all this, if a burn happens to occur on the front of the abdomen where the walls are very thin, the immediate consequence is liable to be the occurrence of a mild degree

of peritonitis produced by the irritation of the burn, with serous effusion or ascites inside the abdominal cavity; or, also, as is occasionally seen in large burns about the thorax, the pleural cavity becomes filled with fluid, and there is pleurisy under the seat of the burn. These facts must make it plain why it is that the location of the burn is of so much importance, and the extent of the burn is of so much importance. I do not care to add the depth of the burn as regards the prognosis and the symptoms. We agree about the depth in this way, that it is going to produce a serious and hard scar; but it is not so dangerous to life if a burn goes in several inches into the flesh, as if a superficial burn spreads over several feet of surface on the abdomen, or thorax, or upon the thigh.

There are three periods of danger in a burn. The first is immediate and is due to the shock, which occasionally produces fatal collapse. The next is due to the internal congestions and inflammations with fever, which are liable to follow immediately from the destruction of the skin; and the third period of danger is, if these have been passed through, the long-continued suppuration which follows the repair of the burnt surface; throwing the patient very much into the condition of hectic we see so often in the wasting suppuration of the joints and of the spine. Shock, then, first; then a period of inflammation; and then the period of exhausting suppuration.

The most marked and curious pathological result on the internal organs from the burn is the effect on certain portions of the mucous membrane of the alimentary canal; and, for some unknown reason, these troubles seem to expend themselves upon a certain tract, and that tract is almost invariably the duodenum, just below the pylorus, where circu-

lar, punched-out, depressed ulcerations, with hæmorrhage, are common. It is a thing to be looked out for. The statistics from autopsies show that ten to twelve per cent. have these ulcers; and when they occur they are the cause, occasionally, of a fatal termination of the case. The symptoms are not very marked. The diagnostic symptoms would be diarrhœa and bloody stools, and, perhaps also, vomiting, though not always; great pain or tenderness over the duodenal region is said not to occur to any very great extent. They are not marked symptoms. The nausea, diarrhœa, bloody stools are the signs of duodenal ulcer. They indicate to us, of course, that our treatment should be directed to do what we can to allay the excitability of the mucous membrane and to allow it to heal. We should try then, by simple treatment, to allay irritation by opium; to check diarrhœa by the same means; to give only those kinds of food which would leave the least possible sediment to pass over the irritated bowel; to choose that kind of food that would be digested by the stomach alone rather than in the duodenum; and by such treatment as this, endeavor to promote the healing of the ulcer. Perhaps, also, we may be able to prolong the patient's life, and give them time to heal, by rectal nutrition; by enemata and stimulants administered by the rectum.

Acute congestion of the kidneys followed by albuminuria will have to be treated as it would in other cases of commencing Bright's disease, or in other cases of congestion of the kidneys, by endeavoring to see as far as possible that the function of the skin, where it has not been destroyed, be kept up by promoting sweating; by warmth applied to the surface; and by giving diluent drinks; possibly, in bad cases, applying cups over the kidneys.

To recapitulate, we say when a patient is burned over a large surface he is in much greater danger than if burned deeply over a small surface. The three periods of danger are: first, immediately from shock and collapse; next, from inflammation and congestions internally; and, finally, from suppuration.

What are the phenomena and appearances of a burn when first received? The pain, we all know, is intense, terrible, demoralizing. Directly after this follows a period of partial collapse; that is, if the burn is severe, the temperature of the body falls and the patient complains of cold; is chilly, shivers. After this has gone by the pain still continues; and a period of acute heat and inflammation gradually comes on, with restlessness and fever, and perhaps some signs of trouble inside the cavities of the body.

The shortest way to stop the pain of a moderate burn upon the surface is to get it covered in from the external air as speedily as possible, and restored to the normal temperature of the body, in other words, warmth and occlusion from the air are the means of checking the pain, and checking the shock. You will see why this must be so. The skin is burnt off. These terribly sensitive nerves are all exposed to a different temperature and they are in great pain from this exposure. There is no cure for it but to make some sort of an artificial skin, which shall cover them in from the air, and restore the temperature and keep them still. That is one treatment which is perhaps the earliest and most important of all. Nothing else does any good until this is done. But other methods of treatment also are important. It is important to give stimulants, and to give opium in the first stages of this pain and shock. Opium should be given gradually and

cautiously, until the patient is quiet and easy; and stimulants freely in the period of collapse. Then the patient should be kept warm, and the burnt surface covered in from the air. This expresses the very simple rules of the earlier treatment of burns. In carrying them out some little judgment is necessary. Supposing, for instance, the patient is a child, who has fallen partially, that is the legs or arms or some part of the body, into boiling water. The clothing is on. The child is scalded through and through under the clothes; and the cuticle is all loosened and ready to peel off. If we can preserve that cuticle without peeling off, that is the best covering for the burn itself; and if that is stripped off, it is a great loss to the patient, increasing the suffering and preventing repair. In taking off the clothing we are apt to destroy all that cuticle; and hence comes the important rule that no clothing should be drawn off from a burned patient; but everything should be sacrificed without consideration as to value; slit down with sharp scissors, and laid off so that the cuticle may be left upon the part. That is a very important point.

Next to that, the burn being seen, what shall be applied? Anything that will cover it in from the air. According to the degree of burn, various substances may be used. If we accidentally get the hand for a moment upon a hot stove and withdraw it and find it reddened and vesicated over a small surface without the epidermis being actually denuded, that form of burn will be relieved, as regards pain, by sprinkling it over with common table salt. That is the common expedient of cooks. They are being burned here and there all the time. They wet the part and cover it instantly with salt, and the pain is relieved. A similar

treatment, a very good one, is to tie the part up at once in dry cotton batting; and cover it in from the air in that way. That also relieves the pain to a very great degree.

For a person with burns so severe that the skin is peeled up, and a bubble of fluid is formed under it, the edge is denuded and serum is flowing out, in that case, the salt is not applicable; neither is the cotton batting. The best treatment for that is to dust the part over with flour, and allow a species of artificial scab to form over the part, which is then loosely bandaged. Any dry or innocuous powder, like flour, or powdered starch, or rice powder, is perfectly good to cover temporarily a burn. It shuts it in from the air, and makes a very good temporary dressing.

Again, another class of substances which exclude the air almost better than anything else are those which contain grease, or fat; any form which is free from salt, and which is not rancid will do for this purpose. The simplest and most applicable, usually, is olive oil. Castor oil is equally good. Castor oil is an irritant to the mucous membrane of the bowels, but not an irritant to a granulating surface. It is innocuous, smooth, thick, holds its place well. The fat of mutton is good. So are the simpler salves, as rose-water ointment, or benzoate of zinc ointment. These common remedies are generally used first; and nothing affords the relief that the rapid pouring on of some soft, soothing form of oil or grease does upon the surface. The pain is allayed very soon, and the part is protected from changes of temperature and from the irritation of the air. One of the common remedies used, which is very good and used largely, is what is called carron oil, made of boiled linseed oil and lime water. This makes a nice covering; soothing and cooling for a burn. The only objection is the odor,

which in burns about the face is very disagreeable from the smell of the linseed oil. This can be overcome, to a certain degree, by the use of some simple perfume. In all burns about the parts distant from the nose it is as good as anything you can possibly put on.

An artificial cuticle made in any way is good for large and deep burns. Sometimes it is made by dissolving gum-arabic in water with molasses; sometimes from various forms of gluten; anything which will form a scab on the surface in drying. It must be unirritating, and it must dry in the form of a scab. Now, this is an excellent application, makes the patient perfectly comfortable, and supplies the place of the lost skin. Unfortunately, it is apt not to be permanent, and has occasionally to be renewed. The reason that it is not permanent is twofold: in the first place from the slight movements of the patient; and in the next place, every burn in this class of burns pours out serum or pus, and these lift up and burrow through the artificial cuticle, and it requires either to be taken off, or patched, occasionally.

So much for the earlier treatment of these burns. As for the later treatment, then we come to the period of suppuration, which is a peculiar and very tiresome one. The ulcerations of burns are peculiar in this way that the granulations are very large and florid and sensitive. It seems as if nature was making an extra effort to repair the burn, and instead of granulating quietly, as the ordinary ulcer on the leg will do, when not inflamed, this turns out masses of papillæ-like growths, which are made up of little masses of cells with a vessel and nerve in them; active granulations which occasionally become watery and œdematous and swollen, and bleed easily at the slightest touch, and are very sensitive. They are what we call in the ordinary ulcer exuber-

ant granulations, or "proud flesh." This is the common form of healing a burn; and it gives a great deal of trouble in taking care of it. It overgrows, so to speak, in repair. It rises beyond the level of the original parts. It is extremely sensitive, and it secretes a great deal of pus.

The oily applications, or the artificial cuticle, are generally the best things for this sort of case also, to allay the irritation. We should not, I think, look upon the pus which is developed upon these surfaces as an unmixed evil. It is a good covering; a poultice to the part; shields it from the air, and enables healing to take place beneath. You no doubt are familiar with the fact that healing by granulation goes on rapidly under the suppurating fluid, frequently; and although the suppuration is excessive and is to be cleansed well, it is a question whether cleansing it too often does not interfere with the process of healing. At this later stage, when suppuration is going on so rapidly, it is difficult to do much with the artificial cuticles; and we have to trust to what are called open dressings, and to change them. To change them often is productive to the patient of terrible shock and terrible suffering; and this is especially the case with children, who, of course, are unwilling to reason, cannot reason on the treatment which is being pursued, but dread the dressing as they do almost a sentence to be flogged; and scream and cry and exhaust themselves in anticipation of it, whenever it is about to take place; therefore it has been found, that frequently, in these burns it is not best to dress them too often; and instead of being kept in a state of most scrupulous cleanliness, they had better be dressed once in forty-eight hours, rather than in twenty-four, since the suffering is less, the shock is less, and the patient gets well quicker.

Nowadays repeated attempts, and sometimes successful ones, have been made to apply antiseptic methods to the subsequent treatment of burns; and so far as they can be used they are extremely useful, but the difficulty is in dressing often; in not allaying pain; and in destroying too much, sometimes, the covering of suppuration. The various gauzes are not very well adapted to apply to the granulating surfaces of a burn, because the fine web of the gauze catches on the smaller granulations and is washed off by suppuration; or, if it sticks, too great pain occurs in detaching it. On the whole, probably, these cases get along about as well with the treatment by the oily applications; but when we come to a much later date, when the acuteness of the burn has largely subsided, and when we have left a chronic indolent ulcer of large extent, not very sensitive, as it is not in these later stages, which cannot heal, then the method of skin grafting, and especially the more modern method known as Thiersch's, by laying on thin slices of cuticle and protecting the whole by a water-proof covering of thin rubber, is extremely useful and extremely comfortable; and this treatment may be used in the later stages of burns with great success.

When called to a burn, we are to allay pain, and give stimulants, at once. Be excessively careful how the clothing is got off. If a child is burned badly, put it to bed under a cradle; and apply the dressing you need. Apply warmth at once. Keep up the bodily temperature; for, strange, as it may seem, while the first suffering is from the intense heat of the burn, the subsequent suffering is from collapse and coldness; and you want to restore the circulation and the natural warmth of the body. Give opium and stimulants and warmth. Get the clothing off carefully,

and dress the burn temporarily, at any rate, with the first bland agent which is at hand, which will cover it in from the air. Subsequent dressings are to be made infrequently. Watch for complications of the brain, or chest, or abdomen; and treat them as well as you can; and, in the later stages, when the exhausting period of suppuration comes on, the patient must be treated precisely as in other cases of hectic; and tonics, stimulants, etc., used, to try to make up for the great waste of this suppurative process.

Unfortunately this is not all that is liable to follow. Unfortunately this exuberant granulation of the burn, this peculiar form of ulceration and reluctant healing, is followed by an unusual deposition in the scar of elastic or fibrous tissue, and by intense contractions; and that is the thing you must guard against all the time. The fingers, the elbow-joint, the knees, the neck, all are the seat of disastrous, contracting cicatrices. The same condition also affects burns about the orifices of the body: the mouth, or nose, or vagina; the mouth and the nose especially, which are frequently burned, subsequently heal in such a way that the mouth may be drawn down into a puckering ring where it is impossible to use the lips well, or the nose contract so that the patient cannot breathe through it with comfort. Also we must be on guard lest contiguous surfaces contract adhesions and grow together. This is especially true of the fingers; which, if they happen to be badly scalded and lose their cuticle, the whole cuticle coming off like a glove, subsequently will heal with adhesions across, and tie the fingers together in a web, if we are not extremely careful. This is doubly true of a little child, where they are intolerant of treatment, and cannot understand what we are trying to do. It is of vast importance, in treating

burns of the hands and of parts contiguous, that they should be kept strenuously open to prevent subsequent contractions and adhesions between the fingers. To prevent the contraction of parts, pulling up of the knee, etc., we have to have recourse to mechanical means, and apply splints to keep the parts well straightened, while healing is going on. On the hand, for instance, a dorsal splint and the fingers strapped back as firmly as possible, if there is danger of contraction; or an outside splint may be made of tin, to keep the arm straightened at the elbow.

If the skin is badly burned in the neck, the consequence is, first, pulling on the chin; then on the angles of the mouth; then on the eyes; so that, in some extreme cases, the patient has the chin drawn down nearly to the sternum; cannot close the mouth; cannot close the eyes; and is, of course, a horrible object, and very miserable for the rest of his life.

Here I would like to call your attention to a treatment, which has been successfully used in Vienna, and some other places, in cases of bad burns in the state of cicatrization, by hot water; keeping the part, if it is a limb, constantly immersed in hot water, kept at the temperature of the body. Baths have been contrived for this, with a little grating on which the patient can lie, and the part be nicely submerged; or else a little tank has been constructed in which the arm can lie, and the temperature be kept steady; and there is a little feeder of warm water to supply the waste by evaporation. No dressing is needed on the burn whatever, except the water. The burn heals in the water nicely; and it is claimed that it heals with a soft and supple scar. This treatment certainly is worth following out.

Provided we are left, after all our efforts, with distortions

and cicatrices, what can be done? We have spoken of the means of skin grafting to enable a large ulcerated surface to heal. I think the method of Thiersch is the best. Now you must bear in mind that skin grafting by taking minute points as large as a grain of wheat from the epidermis has been used fifteen or twenty years, and is successful, but slow. Thiersch's method is more rapid. The cicatrices, however, after they have contracted, have to be treated in another way; and that is by section, and transplantation of flaps of skin, if possible, into the diseased surface. This sometimes can be done with great advantage in the palm; especially at the elbow; care being taken to cut out all the cicatrix, and match the new flap to skin which is sound. It is extremely difficult to make cicatricial tissue unite to sound skin without suppuration, and without giving way, and without a new ulceration; so that, if possible, a part must be selected where the whole scar is cut out, and a nice bed of sound skin left all around; and a large flap of sound skin taken and turned in, with a nutritive pedicle left. I would emphasize this point, that you must cut away all of the scar; and also that when you want to make a flap to turn in, you must make it a great deal larger than to fit the bare spot, for it shrinks to one-half the size.

XV.

INJURIES OF THE HEAD.

I AM well aware that this lecture is nothing but the outline of a great subject; and it would be impossible to do it justice in an hour. Perhaps it would be impossible for me to do it justice at all; but what I want to do is to give you a plain description of essentials, so that you can work up the subject for yourselves.

No injury of the head can be considered trivial, because the most simple one may lead to fatal consequences. Why that is so is most simply explained by considering the close connection between the contents of the cranium and the outside. We have on the surface a very loose covering over the skull; quite thin skin; very little cellular tissue; a slipping fascia attached to the occipito-frontalis muscle, and a pericranium or periosteum, and then the bone. The bone is not solid. It has a tough outer table. It is permeated with vessels through the centre; and the inner table is brittle and glass-like. Then we come directly to the dura mater, which is attached to the inside of the skull, and really performs the function of an inner periosteum and nourishes the bone. You know with what difficulty it is stripped off from the inside of the skull. The dura mater, however, differs from the periosteum in the fact that it is a fibro-serous membrane; and, consequently, it is very prone to inflammatory changes. You know the delicacy of serous membranes; the rapidity of their circulation; how easily they become irritated and

throw out an excessive amount of serum; how, as in the pleural, or peritoneal cavity, that serum changes to fibrin, lymph or into pus. The inner surface of the dura mater, which is serous, forms a cavity called the arachnoid, a serous pocket, which supports the brain, and runs in various directions; and at the inner side of that, we have a close, glistening, vascular layer called pia mater; and then we come to the brain itself. Therefore, while the brain is pretty well protected from external blows from the hardness of its envelop, yet it is not as if it were provided with a shell which had no connection with the outside world. It is closely connected by vascular connections, and also by the two layers of its nutrient membrane, dura mater and pericranium.

The simplest form of injury received outside of the skull may lead to trouble inside. A person may receive a scalp wound which does not injure the bone, but it may suppurate inside the dura. The suppuration may easily penetrate and burrow beneath the fascia of the occipito-frontalis muscle. It denudes the bone of its periosteum; leads to necrosis of the bone, the outer layer. There may follow phlebitis and plugging of the little veins of the diploœ; transmission of the septic material through the diploœ and the inner table; and, often, affection of the dura mater and its serous lining; and that means meningitis and all its consequences. The same thing may follow from a blow upon the head which has not broken the scalp, but has slightly bruised the bone and periosteum, and which may lead to subsequent periostitis with suppuration; necrosis, and exactly the same consequences. We expect, of course, that when a person receives a blow upon the skull severe enough to fracture the bone, that this envelop having been cracked through, an en-

trance has been offered to any sort of septic material which may be the cause of disease; but this may also be the case after the slightest possible forms of injuries. I think I have said enough to show that a slight fall upon the head, a slight blow upon the head, may, in a sensitive subject, transmit the effects of violence to the brain with great rapidity, and with septic consequences. In addition to this you must remember that inside of the skull is the brain, reposing, to be sure, on a water-bed, and prevented, as far as possible, from jars, by the interposition of water, and of tough membranes called the falx and tentorium, which line it off as it were; and separate one part from another; preventing the jar of one portion from being transmitted to another; so that it is protected as far as possible; yet in spite of all this, the delicate tissue is liable to be shaken up and jarred by any violent fall, or blow upon the skull itself.

The simplest form of injury that the brain substance can receive is temporary, and is called concussion; shaking up. Old authors made a great distinction between concussion and compression. They attempted to classify as concussion everything which did not result directly in pressure on the brain followed by coma, stupor and paralysis. But we now know that this distinction was too nicely drawn; and that between simple concussion and real compression there are three or four intermediate stages, that sometimes are very disastrous in their consequences; and which, frequently, can be distinguished from one another.

We confine now the term concussion to a condition like the following: the patient falls; is temporarily stunned; that is to say, the brain is so shaken up that for the moment it loses its functions. Temporary unconsciousness ensues; the patient becomes pale; the pulse flickers a few moments.

Phenomena very like syncope ensue. In a few minutes he rouses; is dizzy; gets up; regains consciousness slowly; has a certain amount of nausea; and then, afterwards, for the rest of the day, or for a short time, has headache, and the trouble is over. That is the simplest form of concussion. It is followed by no appreciable lesion. It is as if we had dropped some delicate instrument, like a watch, upon the floor, and temporarily stopped the works. Picking it up, and giving it a little shake, sometimes the watch will start on as if nothing had happened. So with the brain; and if such a case should be examined at the time, undoubtedly we could find nothing in the brain itself left behind as a trace of the injury. That is, there is no real lesion.

On the other hand, the patient may receive a like injury, but a little more severe, and instead of recovering consciousness at once, may continue insensible for some little time; and only regain consciousness, perhaps, after some hours, when he slowly returns to consciousness; is sleepy; stupid and pale, and bathed in perspiration; has nausea, perhaps, for another day, and then slowly and gradually comes out of this condition, without any appreciable lesion, and recovers perfectly. That is the second stage, so-called, of concussion. In that case concussion has been followed by a moderate amount of effusion of serum in the ventricles and in the arachnoid cavity, producing temporary compression of short duration; it is speedily absorbed again, and the patient is restored to health.

Another degree still more severe is this: the patient goes through the same phenomena; they last much longer; instead of getting well in a day he gets well in a few weeks, or more. During this time he has positive symptoms of compression of some part of the brain, followed by slight local

paralyses; and then, after a while, he recovers even from these. In that case the concussion has been followed by the rupture of some small vessels and by effusion of blood; which blood has coagulated; has compressed limited areas of the brain; has been slowly absorbed, and the patient has recovered.

And finally, there is a stage of concussion which is extremely common and whose symptoms are very peculiar, and which is called, sometimes, concussion with contusion of the brain. In other words, the brain is bruised. The patient receives a blow; goes through the usual phenomena of unconsciousness for a short time; rouses from the supposed concussion. There is no paralysis left; but there is high temperature; there is a general irritable condition of the special senses: acute hearing; disagreeable sensibility to light; pupils usually contracted; and frequently one contracted a good deal more than the other; irregular pupils; restlessness; want of sleep; general nervous excitement without positive delirium; this condition coming on for a week or more; then being followed by severe symptoms of fever; by a chill; by paralysis and by death. In these cases we have what is called concussion of the brain with contusion or bruising.

First, the shaking up; then the skaking up that went so far that it lacerated some part of the brain. Now, where is that most likely to occur? Obviously if we look at the inside of the skull we must see that that is more likely to occur somewhere about the base of the skull; about these numerous irregularities of the fossæ of the base of the skull. Accordingly the contusions of the brain are generally found somewhere toward the base of the brain; and the symptoms produced, of course, vary according to the particu-

lar part of the nervous centre that is injured. These contusions often are of extremely limited extent; and a careful watch sometimes has to be made for them at the autopsy to find where the mischief has been. We do not find a large softened spot of brain; and do not find, perhaps, any large effusion of blood; but search shows, that in certain places, what are called miliary extravasations have taken place. I mean by miliary extravasations the same minute points that we mean when we speak of miliary tubercles in the lungs. Little clots; little softenings; little tumors; capillary bleeding which give rise subsequently to gradual arrest of the circulation of the part from pressure; and afterwards to softening of the substance of the brain; and to minute abscesses, followed by coma and death.

When a man is knocked over, gets up and goes about his business and feels no great disturbance except slight headache, he has been stunned, and has had a slight concussion of the brain. Anything beyond that is almost always accompanied by some permanent lesion; one that will last for hours, or days, or longer. In the simple cases, effusion of serum; in the more severe class of cases, effusion of blood; and in the severest class, bruising of the brain substance itself.

Now, on the other hand, when a person, for instance, receives a blow from a club in the hand of some other person upon the top of the head, and is knocked down in consequence, a scalp wound may be produced; in which case we wash away the blood and look at it, and find a large piece of the skull driven in; never driven in squarely; but compressing the brain substance itself. Such a piece of bone, if raised, is frequently found to have torn the dura mater; and it not infrequently happens,

when we first see the patient, that we find portions of cerebral substance oozing from out of the chink where the bone has torn through the dura mater and lacerated the brain itself. Such a patient is felled unconscious, but he never rouses. As long as he is untreated, he never rouses. That is true compression of the brain. A blow which has knocked in the skull, lacerated the dura mater, crushed the brain substance and interfered permanently with the function of the brain by pressure is called compression. A case so marked as this gives very marked symptoms; and quite distinct from the symptoms of the various degrees of concussion that we have mentioned. Such a patient has dilated pupils, which are wide open and will not respond to light. He snores in respiration, just as a patient does under the profound anæsthesia of ether. He sweats profusely. His pulse is extremely slow and full and labored; sometimes sinking as low as fifty, forty-eight, forty-five or forty, or even thirty beats a minute. It is regular, and full and bounding; but extremely slow. He is practically dead to consciousness. He is unable to swallow; unable to rouse; does not use his limbs; is perfectly unconscious. This condition, if not interfered with, terminates in death, but not immediately. The patient lasts quite a while; generally into the second day; sometimes a few hours; but usually thirty-six to forty-eight hours, before he gradually sinks and dies, with an interrupted, sighing respiration, without the slightest return of consciousness. This is pure and distinct compression. Between such a state as this and the condition of a patient temporarily stunned, who is quickly roused; with flickering pulse; irregular pupils; nausea, etc.; the distinction is extremely marked. Simple concussion, the lighter degrees, are usually distinct from those of pure compression;

and it is only when we come to cases of concussion of the third and fourth classes, where there has been a lacerated blood-vessel, or bruised brain, that the symptoms begin to run together, and it is difficult to tell the symptoms of concussion with contusion from those of compression itself. I speak of this more particularly because in the older books on surgery a distinction was made between concussion and compression. Concussion was so-and-so; compression so-and-so; as if all cases of head injury, which were at all severe, could be classed at once as simple concussion, or profound compression; whereas they grade into each other; the condition of the pupils now has come to be less and less regarded as diagnostic of one from the other. The most important prognostic point about the condition of the pupils, which seems to have been brought out by late investigations, is whether, or not, they will respond to light. If they respond to light, a large percentage rouse and recover; if they do not respond to light, a very large majority never rouse from the condition of coma. The patient may be unconscious; and yet the pupil, if a bright light is thrown on, may act, or may not act, and that seems to give us a very important guide as to the future of the case.

When the concussion is accompanied by effusion of serum, it is poured out about the seat of the injury in the arachnoid cavity. This also distends the ventricles, adds largely to the amount of cerebro-spinal fluid, and makes a temporary serous apoplexy, as it is called; temporary serous compression. This does not last long. It is soon absorbed and goes away. It would be hardly worth while to inquire where such an effusion of serum probably begins. It soon becomes diffused; and its symptoms, which are produced

in a few minutes, seem to be about the same no matter where the first blow was received. It is absorbed again and its symptoms pass off. Not so with the effusion of blood. It makes an immense difference where the effusion of blood starts from. After a blow received upon the head which ruptures a vessel inside the skull, blood may be poured out in quite a variety of situations according to the vessel that was wounded. In the first place, it may be between the dura mater and the skull; in which case it is very distinctly localized; and cannot be poured out very rapidly. It has to dissect up the dura mater from the skull itself; slowly tearing away the membrane from the bone; and by the hydraulic pressure of the pumping vessel a clot is slowly formed between the skull and the dura mater; it coagulates, and separates the membranes from the skull.

On the other hand, the effusion of blood may take place inside the cavity of the arachnoid. The vessels may be ruptured there. In that case the hæmorrhage goes on rapidly. There is nothing to arrest it; nothing to localize it, or determine where it shall go, except the thousand accidents which may come from the position of the patient, the side on which his head lies. The effusion of blood in the arachnoid cavity rapidly diffuses itself in any direction according to the laws of gravity, and ceases to be localized very soon after the vessel is ruptured.

Not so from the laceration of deeper vessels about the base of the skull, which result from a tear of a nutritive vessel permeating the brain substance itself. These must be localized. They form local clots; their phenomena resemble those which follow an ordinary attack of apoplexy, where one of the nutritive vessels in the brain bursts and a clot is poured out; is localized; pushes aside brain tissue; can-

not become very large; and the symptoms produced are due to the loss of function of that particular spot of the brain where it occurs, and the part of the brain which it happens to compress.

In old times, Mr. Pott, an eminent surgeon in London, wrote a book on trephining the skull for injuries of the skull and lacerations of vessels, in which he thought he could determine the place where the vessel was ruptured, trephine and remove the clot, and relieve the symptoms and cure the patient; and for a certain percentage of cases he did so, but it so happened that, in all probability, the larger proportion of Mr. Pott's cases were those of extra-dural hæmorrhage; that is, between the dura and the bone. The vessel most likely to be ruptured there is the middle meningeal artery, which passes up behind the inner side of the temporal bone, one and a fourth inches behind the outer angle of the orbit. A blow being received in that vicinity, if it ruptures a vessel inside the skull, is more likely to rupture the middle meningeal artery than any other. A blow on the squamous portion of the temporal bone is likely to crack through that bone and to rupture the middle meningeal artery. Probably a good many of Mr. Pott's cases were rupture of the middle meningeal artery. The effusion was localized; was directly beneath the site of the blow. The bruise on the scalp, or the cut on the scalp, led to the location of the clot inside the skull. On trephining he found the clot; removed it, and the patient was relieved.

On the other hand, we have no guide as to the location of effusions of blood in the arachnoid cavity. They are poured out, diffuse themselves, may go anywhere within the arachnoid cavity. The coagulations, however, which take place

in the brain substance, from rupture of a vessel there, produce as distinct and permanent a class of paralyses as the various forms of apoplexy, and can be localized better.

Perhaps it is well, in this connection, to point out to you the very great distinction which exists in the rapidity of the symptoms that are produced between compression caused by a piece of bone driven down upon the brain, and compression caused by extravasation of blood between the dura mater and brain from a tear of the middle meningeal artery, or from some other vessel between the skull and the dura mater. Take the patient who is knocked down we will suppose with an axe; the skull driven in; he is instantly felled and unconscious; lies comatose — this is an example of compression. On the other hand, the patient who has received a blow rupturing one of the extra-dural vessels goes through the following series of phenomena. At first he is stunned; he rouses from that; after lying a few moments he is able to get up; feels dizzy and uncertain, but retains consciousness, and is frequently able to walk; grows better for some little time; and it is only after the lapse of a half-hour, or hour, that he begins to feel a sense of terrible weight and stupor in the head, and gradually becomes more and more dizzy, until finally he drops into a state of paralysis and unconsciousness and compression. This arises from the gradual effusion of blood, which is poured out with great force between the dura mater and the skull; dissects the dura mater from the skull in proportion to its size; must compress the brain, because the skull cannot yield, and the dura mater and brain can.

Compression from hæmorrhage just inside the skull is gradual; compression from the driving in of bone is immediate. These are the general distinctions between the two.

All the phenomena of head injury, however, as regards the point where the blow was received, and the consequent injury, are very much modified and confused by another force which comes in play, and which is called contre coup; that is, transmitted force to the opposite side of the skull. Hence effusion of blood and the phenomena of paralysis may be all due to an injury at a point directly opposite the point at which the blow was received. This, of course, confuses very much the diagnosis and prognosis of brain injuries.

We hear a good deal of fractures of the base of the skull. They are various in character. There are certain parts at the base of the skull which are quite thin and which more readily break than others. These are called fossæ. We have the anterior, middle and posterior cerebral fossæ. The anterior cerebral fossa is formed by the roofs of the orbits, which are extremely thin; and it is bounded by the glenoid process of the sphenoid bone, which separates it from the next, the middle fossa, which is quite thin. This is bounded by the firm structure of the petrous portion of the temporal bone. Then we have the posterior fossa, where the occipital bone is quite thin down by the foramen magnum, bounded by the temporal bone in front and the thick occiput behind; and it is thin also over the venous sinuses at the base of the brain.

Fracture of the base of the skull is difficult to diagnosticate, because we cannot see anything; can trace nothing; can feel nothing about the skull. The injury is where we cannot trace the fractured bone, or be guided by any of the ordinary signs; and can only infer and reason from symptoms, where, probably, a fracture of the base has taken place, if it has taken place at all. The patient may be in a state of compression, and yet there may be no evidence of depres-

sion of bone upon the surface of the skull. The question then arises whether this compression may be due wholly to laceration of brain and formation of clots, or whether it is accompanied also by fracture of the bone, out of sight, in the base of the skull. It is sometimes difficult to distinguish between the two. There are certain phenomena which show themselves outside which enable us to judge to a certain degree; and these phenomena are quite important. In fracture of the anterior fossa of the base of the skull, we have the roofs of the orbit cracked through more or less; have the cribriform plate very easily cracked through; and occasionally we have also an opening forward into the frontal sinus; but, at any rate, the cribriform plate, or the roof of the orbit, is almost sure to be broken through. Two series of phenomena follow: nose-bleed coming from the cribriform plate, from the rupture of veins there; and the other is what we call subconjunctival ecchymosis; ecchymosis not in the ordinary form of black eye which breaks the vessels of the lid or conjunctiva, but bleeding which takes place beneath the conjunctiva, and spreads itself over the sclerotic coat of the eye. This is due to the rupture of vessels deep in the orbit. In severe cases this blood may extend, if the crack through the orbit is extensive, may extend elsewhere; and gradually the patient will exhibit discolorations upon the face and neck several days after the injury; the face becoming black-and-blue, in extreme cases. Ordinarily, we have nose-bleed and ecchymosis in the orbit.

Now, on the other hand, if the middle fossa is broken through, the most likely place where blood will be poured out is into the throat and mouth. The top of the pharynx is attached at the junction of the spheno-occipital bone; and hence bleeding into the mouth and throat is not uncommon

in consequence of fracture of the middle fossa of the base of the skull. Inasmuch as the petrous portion of the temporal bone is so near, frequently we have lacerations which extend through the middle chamber of the ear, and cause bleeding from the ear itself. Bleeding from the ear, and serious discharge from the ear, have long been considered among the most significant symptoms of fracture of the middle fossa of the base of the skull. They are not, however, diagnostic. The bleeding from the ear is quite common in severe injuries of the head, and does not necessarily mean any injury of the bone. Any small vessel may be ruptured, and bleeding take place. Neither does the discharge of serum from the external ear, unless very profuse in quantity, necessarily mean fracture of the middle fossa about the base of the skull, and the leaking of cerebro-spinal fluid. When profuse and long-continued, then it can be nothing but cerebro-spinal fluid, which runs out through the fracture of the middle fossa at the base of the skull and the laceration of the membranes; it is increased in quantity by the irritation of the injury, just as we see in other cases where an injury has been received; and it is poured out in large quantities. This, however, is extremely rare. When it is seen, it is a diagnostic symptom of fracture of the middle fossa of the base of the skull.

When, however, the serous fluid is only seen slightly, for a short time, doubtful, mixed with blood, it may mean nothing more than the liquid contents of the vestibule and labyrinth which have leaked out through the fissure of the drum; and possibly the partial fissure of the temporal bone, which may not extend inside of the skull to the cavity of the brain.

One other symptom, however, may arise in this connection,

which is very characteristic, and that is facial paralysis. Facial paralysis, if it occurs in connection with these other symptoms, is almost diagnostic of fracture of the middle fossa of the base of the skull, because it shows that the petrous portion of the temporal bone has been broken through; that the facial nerve has been compressed in its bony canal, and facial paralysis is the direct consequence.

In the posterior fossa, also, we have laceration into the ear. We have also other symptoms; we may have bleeding into the pharynx, the same as in the middle fossa. We have one other symptom, quite diagnostic sometimes, and that is a break through the lateral sinus, and effusion of blood in and behind the mastoid process, and out in the neck; large ecchymoses gradually forming behind the ear, and running down the back of the neck. These are very marked; and indicate, almost invariably, rupture of the lateral sinus, with leaking out of venous blood into the tissues behind the ear, behind the mastoid process, and down between the long muscles of the neck.

Nose-bleed, subconjunctival ecchymosis, bleeding in the pharynx, blood and serous discharge from the ears, facial paralysis, large ecchymoses behind the mastoid process — those are the common phenomena accompanying fracture of the base of the skull.

Fracture of the base of the skull can hardly occur without cerebral laceration and some effusion of blood within the skull itself; therefore the symptoms are almost always of the mixed variety. There may be complete unconsciousness. There may not be. It depends upon the amount of compression. If the patient lives, the case is a long one to recover. Some of them do recover. It sometimes is a long one, if it has a fatal result; and fracture of the base of the

skull is occasionally followed by prolongation of life for a week or ten days, during which the patient finally sinks, with symptoms of cerebral abscess and softening.

One great danger that arises in injuries of the head is from the occurrence of septic absorption from some of the wounded tissues. This, of course, is especially the case in wounds which communicate with the air, as in compound fractures. That danger, and the danger of injury of the brain and membranes by fragments of bone, is the next point we have to speak of.

Now the only way that we know of averting the dangers of sepsis and pressure is by surgical interference. Surgical interference in the skull means generally the use of the trephine, because otherwise we cannot get at the injured parts. It is true that occasionally a fracture of the skull occurs which is so comminuted that we have only to press away the periosteum and flesh, to pick out certain loose pieces of bone, and we need no further instrumental interference; but usually the bone is driven in under the sound portion, shelved in under the edge obliquely and fastened there, so that it is impossible to extract it. In order to extract it and relieve the pressure, we have to cut out a button of adjoining bone to get room to insert forceps to remove it.

As little of the sound bone is to be cut away as possible; but the centre of the trephine, of course, must be started on the sound bone, and a piece cut out which includes a little more than one-half the circumference on the sound bone, and the rest on the depressed fracture. That is the usual rule.

Such a thing being fully accomplished, and the piece taken out, then the parts are thoroughly cleansed, and dressed antiseptically, as in an ordinary wound. Sometimes a drainage-tube is put in.

But the most important question for us to consider, and one that is yet not fully settled, is, when it is best to interfere at all. In old times trephining was a very different thing from what it is now. It is not too much to say, I think, that the introduction of the aseptic method has diminished the danger and the mortality from trephining very much. Before the antiseptic method the mortality from trephining was great; so much so that many were discouraged from interfering; and we abstained from using the trephine, if we could find a proper excuse to do so. Now, under the additional safety of the antiseptic method, the tendency has perhaps gone too far the other way; and the tendency of the times is to use operative interference in perhaps more cases than is really necessary.

For a clear understanding of the matter it will be best to proceed in this way: What cases, in the first place, should be trephined under any method of practice — demand trephining? First, punctured, depressed fracture. Some little hard substance, like a bit of iron, or sharp piece of steel, or portion of a block from a ship, falls from a considerable height, strikes the patient squarely on top of the head, produces a minute punctured scalp wound, also a minute punctured wound of the skull, exactly as if a nail had been held against the skull and driven in with one blow of the hammer. At first the patient undergoes the usual phenomena of a temporary concussion; he falls and is unconscious, but soon comes out of that; and, subsequently, he frequently gets up, and often walks to the hospital; and comes in to have a simple scalp wound dressed, not feeling that he is deeply hurt, and not willing to believe it. The symptoms which are produced by this injury are not immediate; and unless we knew, by experience, what was going to

follow in all these cases, after a few days, if let alone, we should not feel called upon to interfere with the patient at all. But the subsequent history is this: the outer table being broken through in a minute hole, the inner table is also depressed and shivered into fragments; and although the outer table may be in one piece, the inner table is almost always in several pieces; minute and detached and sharp fragments, which press in on the dura mater, and surely set up meningitis. They do not at first make sufficient compression to make the patient sick; but in a few days he begins to be sick; symptoms of meningitis come on; and then the little pieces, which are detached and unnourished, necrose, and continue the suppurative process, and set up septic phenomena in addition to the ordinary ones of inflammation of the meninges; and the result is almost inevitably fatal. Such patients have, at first, but few symptoms except the immediate effect of the concussion; have a little headache and dizziness and do not feel much sick. If not treated, in a few days this series of phenomena begins to come on: the patient begins to grow a little restless, uneasy, a little sensitive to light, a little acute about hearing sounds, begins to have persistent headache; his temperature rises, and presently are ushered in the symptoms of acute inflammation of the membranes. Here is a case where trephining is called for at any rate. The patient must be persuaded to submit to it; and a cure, at such an early stage and with so slight an injury of the parts, is pretty sure to be produced; but even if it were not sure to be produced, we should persuade the patient that he should be trephined, on account of the subsequent history, which is certain to be disastrous.

Now the ordinary case which calls for trephining, which I will describe next, cannot admit of any doubt to any one's

mind. The patient has received a scalp wound; the same blow has broken the skull. The skull has been driven in, perhaps cracked in several directions. He lies in a state of coma, unconscious, with stertor and all the symptoms of compression. If you can, lift up the bone; if you cannot, you must trephine, and take off all the pressure from the brain. That case, of course, admits of not the slightest doubt at all.

Now comes another case, which is not quite so plain. The patient comes in with no scalp wound; has a hæmatoma under the scalp. It is hard to tell whether or not he has a depression, but he has the symptoms of immediate compression. He was struck, fell unconscious, has never roused, remains in a state of coma, with stertor and slow pulse. Such immediate effects produced can hardly fail to be due to depression of bone, because there has not been time for effusion of blood to take place, and this latter brings on the phenomena of compression more gradually.

Given a patient who has received a blow upon the head and has symptoms of compression, it is imperative to interfere. If we find fracture, we should trephine. No one can hesitate, with the bone depressed before his eyes and the scalp gaping open, to interfere and remove the piece. It is more difficult to decide and persuade ourselves to cut through the broken scalp; to subject the patient to some risk of a wound through the scalp, which he has not already suffered, to relieve symptoms which are somewhat obscure; but if he has distinct symptoms of compression, I think we should not hesitate to interfere to the extent of making thorough incisions, exploring, and acting according to what we find.

In old times one trephined for this. In modern times we should do the same.

Now come more doubtful cases. The most marked of these is where the patient receives a blow, remains conscious some time, becomes gradually unconscious, and we have every reason to believe is suffering from compression from blood inside the skull, a clot. The whole point turns upon whether that clot can be localized; and, if it can be localized, whether it can be reached and removed by trephining the skull, and then turning out the clot. The location of the injury, if over a large vessel like the middle meningeal; the slow occurrence of the symptoms; the exactness with which the symptoms can be defined, must guide us a good deal in this respect; and, it is fair to say, that if we succeed in finding the location of the clot and removing it, and it is outside the membranes, we shall almost inevitably make a brilliant success. The symptoms will be relieved just as they would by taking away a piece of bone; and the patient will recover. If, on the other hand, the blood has been poured out into the arachnoid cavity, we may not find it, and may not succeed in curing the patient. Now it is in this class of cases, which, so to speak, are on the border-line between interference and non-interference, that we may apply the principles of modern antiseptic surgery, which renders it so much more safe to trephine than it was formerly. There is no very serious mischief produced by trephining, unless we feel obliged to puncture the dura mater and explore inside the arachnoid cavity, or the brain; then we do subject the patient to a good deal of additional risk; and one must judge for himself, from the appearances of the part beneath, and the non-relief of the symptoms, whether it is wise to persevere. Loss of pulsation in the brain, bulging, etc., all those symptoms must decide us, whether it is best to cut down through the dura mater, and seek for the clot.

Much slower symptoms come on when abscess forms. The patient may have received a slight injury. The symptoms at first may be very obscure, indicating perhaps concussion with contusion;—irritable pulse, and rather sleepless nights; one pupil larger than the other, and a mild form of delirium coming on. This may go on some little time, when suddenly there occurs a chill; usually in the course of five to eight days, sometimes in the second week. After this, a profuse sweat and high temperature; and then commencing symptoms of stupor; growing duller; respirations growing slower; pulse growing slow; other symptoms of compression coming on; until finally, if the patient has no relief, he sinks into a state of profound coma, and dies at the end of a few days. These are the phenomena of suppuration occurring around an injured point in the brain; that is, the brain has been bruised; miliary extravasations have taken place; gradually these have undergone septic changes and have softened; the initial stage of suppuration is marked by the chill; abscess of the cerebrum forms, with all the symptoms of compression added to the symptoms of suppuration. Here is a case, then, where under the old method we should trephine with great hesitancy; under the modern method we are quite justified in trephining; in cutting through the dura mater, and in exploring, in the hope of finding pus and letting it out. If we fail, the patient certainly is not any worse than before. He was truly on the road to death under the symptoms he had before. If we succeed, and evacuate the pus, and drain and wash out the cavity, occasionally we get a cure.

These responsibilities are very serious; and we want to be quite clear that the diagnosis is fairly certain, that the patient is quite sure to die as he is going on, before we venture on so profound an injury to the brain, in the hope of finding

a suppurating centre. Hence we see that certain cases are quite clear; while some are quite doubtful. We are encouraged to trephine much oftener than formerly on account of the immunity afforded by aseptic surgery.

There is a class of cases where in old times no one would have thought of interfering, and in modern times people do interfere, and which may be classified as cases where the operation may be justifiable, or may not be justifiable, according to the light of statistics. Such cases as these are essentially chronic cases; cannot be acute ones. Acute ones drive us to a decision, one way or the other, at once. The phenomena are so severe that they usually are pretty clear; but it is the chronic case that can be considered for days; and whose whole history is to be gone over for months; the family history to be considered; whether the patient has descended from epileptic parents; or whether he possibly has original, or inherited syphilis; all these things have to be weighed thoroughly, before we trephine these chronic cases. We trephine, nowadays, for epilepsy; for scar-tissue thought to be the seat of chronic headache and to produce epilepsy; for syphilitic thickening; for syphilitic gummatous tumor; for brain tumors of another class which are usually either soft glioma or sarcoma; and for tension; meaning by that something inside the head which is pressing the brain; irritating; and which may be relieved by cutting a hole in the skull, then cutting open the dura mater, and allowing the tension to be taken off; the serum to drain away; and more room to be given to the parts. For all these things, trephining is occasionally done. It is frequently done without any relief to the patient. It is fair to say, it is frequently done without any damage to the patient. It is extraordinary how, under modern antiseptic methods, a good many of these

doubtful cases are explored and then heal up; and, apparently, are neither better nor worse than before. Some of them occasionally get better.

There is a curious affection of the brain, after the membranes have been cut away, which used to be called hernia of the brain. The pulsation of the brain inside the head, apparently, the moment the tension of the enveloping sheath of the membrane is taken off, pushes the soft brain substance up into the opening; tends to protrude it more and more; and gives rise to a species of tumor, which used to be called hernia of the brain. It has been proved, I think, that the mass that grows out in these openings is not really so much brain tissue, as a sort of irregular fungus growth; a proliferation, which takes place on the surface of the brain. It is difficult to treat. It is frequently fatal. In the older times of surgery it was very commonly fatal, and was very much dreaded. Compression, if applied too forcibly to restrain its pushing out, may produce symptoms of coma and compression of the true brain beneath. Agents applied to it in the shape of styptics, or astringents, or escharotics, have to be used, of course, with a great deal of caution, because they also may light up a meningitis; or destroy true brain-tissue and lead to cerebral abscess. Under the modern treatment hernia of the brain seems to get along much better than it used to; and it is quite encouraging that it does. Keeping it packed antiseptically with gauze; keeping up moderate pressure, seems to check the fungus proliferation, and the formation of serum and pus, which formerly took place to a great degree; and some of these forms of hernia can be led to heal without serious symptoms.

To sum up briefly: We must never forget that any head injury may become serious; that even a slight concussion is

not safe, until a fortnight has elapsed; that it is more dangerous in the child than in the adult; that the child who has received a concussion is certainly not to be considered safe until two weeks have elapsed, although the first few days of headache may have passed off; that this is especially true, and to be regarded with great care and suspicion, if the child happens to inherit a tuberculous constitution, because tubercular meningitis is very easily provoked in such a child; that all head injuries, which are at all severe, are well treated by the old antiphlogistic method, aided by antisepsis (by this I mean reducing and quieting treatment, in various forms); that antiseptics have given us greatly increased advantages in treating scalp wounds, fractures of the skull, inflammations of the brain, extravasations into the brain, and tumors in the brain, from whatever cause; that there are certain very simple rules to be followed with regard to trephining — a few cases which are plain and apparent, such as direct, compressing fractures which are compound; fractures which are not compound, but still are compressing; and punctured fractures; that there is another class of cases where we trephine for clot, or abscess, where the diagnosis is a little more difficult, but still where there is a fair percentage of success; and, finally, there is a very large class of chronic cases, where we balance the probabilities, where we are encouraged occasionally to interfere by trephining, and encouraged especially by the fact that trephining is not the fatal operation that it used to be.

XVI.

INJURIES OF THE SPINE.

It is hard to believe that there can be such a thing as simple concussion of the spine producing lasting consequences. Of course, the spine may be shaken up; but that it can be shaken up in such a way as to produce permanent injury, without positive lesion to other parts, seems difficult to believe. The spine is in a water-bed; floats; cannot swing much from side to side; it is in the midst of a bony column which is linked like a chain, and is not stiff. It is buried beneath a mass of strong muscles; lies in the centre of the body almost. You are surprised to see in the dissecting-room when you cut away the muscles of the back how far the spinal column is in toward the centre of the body. It is wonderfully protected from shocks and jars; so that the delicate nerve-tissue of the spinal cord itself can hardly be damaged very much unless the parts near it are broken in a certain way. Now it is surrounded by a copious blood-supply. The rachidian veins which are developed in and between the membranes are very numerous. If you look in Bourgery's plates of anatomy, which are rather highly-colored, but still pretty true to nature, you will find how extremely vascular the parts around the cord are. It is much more probable that a blow or accident, which happens to the spine, not severe enough to injure the bones or detach them, but severe enough to jar the parts, — it is much more probable that it should rupture some of these numerous dilated

rachidian veins, than that it should shake up and lacerate the cord itself, floating in its water-bed as it is; so that it seems to me improbable that concussion of the spine, as such, amounts to much, unless it is also accompanied by the same sort of injuries that happen in the brain. We have seen that simple concussion of the brain was rare; that where any symptoms persist they are due to positive lesions; and those lesions we call contusion of the brain; we have little vessels ruptured and miliary extravasations. Now I believe, and I think pathology supports it, that injuries of the cord which are supposed to be concussions, but from which the patient does not promptly recover, are due to a positive lesion. That lesion generally is the rupture of a vessel and the subsequent symptoms produced by a clot. Now a clot between the membrane and the spinal cord must act very differently as regards compression from a clot in the cerebral cavity. In the first place, it will gravitate; and it trickles down between the membranes and perhaps lodges about the points of exit of some of the nerves and compresses local portions of the cord; and gives rise to local changes of nutrition or motion, or sensation, but not affecting the whole of the body below where the injury is received. That is the history of moderate injuries of the spine. Either they amount to nothing at all; or if they amount to anything, they are followed by local, limited paralysis, due to effusions of blood.

One will see, on the other hand, a good many people get shaken up in the back, who are lame, stiff, and are weak and incapacitated for a good while; and yet they do not have any local paralysis. How are such symptoms as that to be explained? Apparently the consequences of a very large number of these injuries are external to the spinal cavity itself; that is to say, they are about the ligaments of the

vertebræ, the fasciæ, and the muscles around them. You can remember how fully these parts are supplied with ligaments; how many articulations there are; how many ligaments there must be to support them; how much the erector spinæ and other sets of muscles are made up of fascia. The amount of ligamentous tissue and fibrous tissue throughout the whole back is very much larger than in any other part of the body. Bruises, blows and sprains are extremely slow to recover from. We know that when we sprain the wrist or ankle, or twist some part, that the sprain is slower to be recovered from than a broken bone. Undoubtedly many of the cases of railroad concussion, so-called, are cases of sprains and ruptures of the ligamentous tissues of the back. These are slow to repair. The back remains stiff. A form of rheumatism sets in. Pains located there are hard to distinguish from pains located in the cord itself; and, if the patient is at all of a nervous temperament, a neuralgia is set up, or other symptoms due to what we call hysteria; and owing to the long series of aches, and pains, and disabilities, the observer is led to think that there must be an injury to the cord itself. Frequently there is nothing of the kind. We can test that in two ways. First, by the lapse of time; inasmuch as if the cord is injured, it will undoubtedly go on to further inflammatory and degenerative changes; and a few months will make the patient much worse, and show symptoms which will be decisive. We can test it, in case it has gone on some months without any change one way or the other, by electrical tests; and see whether the contractile power of the muscles is diminished.

Most shakings up of the back are due to injuries outside of the cord. Those which are more severe produce hæmorrhages; and the hæmorrhages are positive lesions, and require

time for their recovery; but they do finally get well. Finally, we have the extreme class of injuries, where in the spinal column the bones are injured; and where positive fracture, dislocation, compression, meningitis, softening of the cord, etc., follow.

The cases which are due to the effusion of blood into the spinal canal are pretty easily diagnosticated after a few days. The symptoms are localized, persistent, and they can hardly be mistaken. Partial paralysis of one arm, partial paralysis of one side of the neck, or any portion of the body, indicates that certain nerves have been compressed, and compressed within the spinal cavity where they emerge, by a clot. This may be so extreme in some cases as to produce paraplegia. A man receives a severe blow in the small of the back. No evidence of fracture or dislocation occurs. The patient is apparently paralyzed below the pelvis and remains so; but after six or eight weeks begins to recover sensation and motion; and after some months recovers perfectly. Such a case is undoubtedly due to effusion of blood; compression of the cord occurs; afterwards it is absorbed, and finally gets well. The milder class of cases give rise to local paralyses; and when we find them we have reason to give a good prognosis, after sufficient time has elapsed. It must be borne in mind, however, that recovery from this sort of injury is excessively slow. It is not to be measured by weeks, but by months; sometimes a year or two, before the patient gets the parts finally restored.

Now in sprains, bruises and twists of the ligaments about the back the patient is often benefited by having an immobilizing apparatus put on. He is better off to lie in bed, and have on a light plaster, and keep the parts perfectly

still, just as we would treat a badly sprained ankle. Subsequent to that he needs light massage; frictions and liniments, and electricity, the continuous current, etc., until he finally recovers.

Fracture and Dislocation of the Spine. — Now we pass to the very serious class of cases called fracture and dislocation of the spine. They almost always go together. It is hard to conceive that the spine can be dislocated without fracture taking place. It is rare; and usually fracture and dislocation are combined.

The symptoms produced must be immediate. There cannot be any waiting for the formation of a clot of blood here. Whatever happens, happens at once. The patient receives his injury; is immediately paralyzed below the seat of the injury; and the amount of the paralysis depends on where the injury is. In the middle of the back he has paraplegia, and also begins to have phenomena of impaired respiration and digestion; and if still higher up, still more startling phenomena appear. Bear in mind that the most common place for the structure to give way is where the neck joins the body. We have here, just above the vertebra prominens, a movable part, the neck, attached to a comparatively immovable part, which comprises the thorax, ribs and sternum; and an injury received upon the back is transmitted above. Fractures and dislocations are most common above the vertebra prominens. If the injury occurs up by the atlas and axis, the odontoid process is thrown forward on the medulla, and instant death is the result: death, I presume, more rapid than from any other form of injury, except by an extremely strong electrical current.

Between the third and fourth cervical vertebræ come out the filaments which form the phrenic nerve, which supplies

the diaphragm with its pumping power in carrying on respiration. If fracture involves that nerve death is very speedy. If, as is frequently the case, fracture and dislocation take place about the fourth and fifth, fifth and sixth, or sixth and seventh vertebræ, then we have a very curious class of phenomena. The patient is paralyzed below the nipples. The chest is fixed. The inspiratory power of the serratus and intercostals is wholly lost. The patient can breathe only with the uninjured fibres of the phrenic nerve; and respiration has to be purely diaphragmatic. The chest does not rise in respiration. He lies on the back, incapable of moving, with the chest as fixed as in a marble statue. He breathes, however, fairly well. There is no suffering. The patient regains consciousness to a perfect degree. He cannot believe he is so seriously hurt; cannot understand that he is fatally hurt. He is sure to die; and in about thirty-six hours, sometimes forty-eight. Death is bound to occur from two causes; one is the compression on the diaphragm from the accumulation of gas in the paralyzed bowels; gas accumulates and is not passed on, fills up the abdomen, enormous distension takes place, the diaphragm is pressed up against the lungs, the lungs cannot expand, and are slowly compressed from the force underneath. Meanwhile another change takes place in the lungs themselves, which is still more dangerous, that is that the elastic power of the bronchi to expel mucus is wholly lost, and the lungs fill up with the secretions of the bronchial tubes. The patient is unable to cough, or expectorate. Between compression below and filling up above, at about the end of twenty-four hours he usually begins to be dull and cyanotic, and his finger-nails to grow blue; and he grows a little colder; becomes stupid, and gradually dies by

slow suffocation; by a merciful form of death, since he is rendered unconscious.

We recognize the injury by these terrible phenomena when we see the patient. We can hold out but very little hope when the injury has been so high up that the respiratory power of the intercostals and serratus is lost. The patient breathes wholly with his diaphragm; is holding on to life by a very feeble thread; and he is almost sure to die in the way I have described.

If the injury occurs a little lower down he breathes better, but he is paralyzed. A little lower down, and he has no disturbance of the heart or lungs; has paralysis of the functions of the rectum and bladder, and paraplegia, and lives indefinitely. The broken backs and dislocated backs, in the middle of the dorsal region, live sometimes months or several years; once in a while recover, but very rarely.

The most important point for us to consider is whether we can do anything in these cases. The symptoms are so marked that we cannot help making a diagnosis; and we are occasionally assisted in the diagnosis, but not always, by an evident distortion in the line of the spine. In the neck it is not very easily recognized, however. The muscles are thrown into tension. The neck may be set back or forward a little; but it is difficult to feel displaced vertebræ in the neck, often. We frequently may be deceived as to the gravity of the injury, at first, by the fact that feeling the point of injury we find crepitus and broken bone. That usually means nothing at all; means a spinous process broken off; but it is the occurrence of all these symptoms of paralysis at once, with or without distortion, which indicates what has taken place.

Nature can do very little. The question is whether man can do anything to help. The most tempting field would seem to be cut down upon the part; to use antiseptic precautions; saw out and trephine the laminæ of the vertebræ; remove depressed fragments; restore the cord to its natural position and circulation, just as we do the brain when a bone is driven in upon it; and occasional instances of cure have resulted; but unfortunately they are very rare; and the reason is this: when this dislocation and fracture of the spinal column takes place the bodies jump over each other, and compression of the cord is almost always on the anterior portion, where it is out of reach of the surgeon. He may uncover the cord; meanwhile the vertebræ are locked over each other in front, and compression is still going on in front. I do not say it is not justifiable to make these attempts sometimes; but the latest statistics I have seen seem to show, on the whole, that up to this date the percentage of recoveries was better in cases that were not interfered with than in cases that were. The encouragement to interfere, to trephine the spine, is very small. If we cut away considerable, we may relieve the symptoms; but the patient will be, in the future, dependent on an apparatus to hold up his head.

Is there anything else we can do? Efforts have been made, with occasional success, to pull the fractured and dislocated vertebræ into place by traction; and once in a while there has been a brilliant case; just as you read, once in a while, of that romantic and typical case, where a man has a piece of bone driven into the brain while in the midst of a conversation; loses consciousness; the bone is removed, and he rouses up and resumes conversation where he had left off; so you read occasionally of cases where reduction of dislocated vertebræ has been accomplished. It is a fair thing to try.

How shall it be tried? The most efficient way is to suspend the patient in a tripod, just as if about to put on Sayre's plaster-jacket for caries of the spine. The objection to the suspension is that the agony inflicted on the patient, and the constitutional symptoms produced, are very severe. The patient can hardly undergo it without ether; and while he is etherized and hung up, extreme care has to be taken lest he stop breathing, and die in the apparatus. In the child, young person, person not weighing very heavily, it is fair to try it; but in the heavy man, the chances of inflicting terrible suffering, and perhaps killing the patient, are something. On the other hand, it is claimed that efficient extension and counter-extension can be made with the body in the horizontal position, if you have plenty of assistants, and the body arranged on an angle; so that you can draw both ways, and draw the vertebra down into place.

We may trephine with a very limited chance of success and of recovery, probably followed by inability to walk, or move. We may extend by the tripod if the patient is not too heavy; we may extend more mercifully by doing it horizontally.

There remains only one other method of treatment, which should be applied to all cases, and can do no harm, and often does a good deal of good; after you have done what you can to draw down the parts, namely, to immobilize the spine; and that is done best by the plaster apparatus; the patient can be encased in plaster, and kept on a bed. One or two little precautions are very valuable. Turn the patient over often if you can, for otherwise he is sure to have a bed-sore. In the plaster-jacket you can turn him over; and it is a part of the nurse's business to turn him at least twice a day. Be very careful of the subsequent care of the bladder. Many of these patients die of subsequent cystitis; and if you can

preserve the catheters and catheterization from sepsis, you may avert cystitis for a very long while.

Some of these patients live for months or years; and some of them waste away and die from affections of the bladder, and degenerations of the kidneys, and other organs.

INJURIES OF NERVES, MUSCLES, BURSÆ, ETC.

You will be at a loss sometimes, perhaps, to explain why it is that a moderate blow, from which the consequent bruising which appears under the skin has long since passed off, remains so painful and disables the parts so much. That is the case where a nerve has been bruised, and where the inflammation in its sheath cannot show outside through the skin and tissues, and shows only in its effects.

The effect is long-continued pain, lameness, and inability to use the part. The treatment is strictly local. In the first place, the limb must be put at rest on a splint. The bruised nerve at first must be treated by laudanum fomentations, and later by more active treatment. In the later stages the application of iodine, or a blister, does a great deal of good; and finally the trouble subsides, after a good while.

When an effusion has taken place in the sheath of the nerve, and it becomes compressed; or when a nerve is wounded and its transmission of nervous influence is impaired, then some other phenomena come on which are characteristic, that is, reddening, glazing and blistering of the skin, especially on the tips of the fingers, along the inside of the fingers, on the palm of the hand. In these patients you will find not only the hand cooler than natural; less sensitive than natural to the ordinary touch, but also the skin vesicating, rubbing off; the knuckles frequently of a bright cranberry color; and the part excessively painful, and very

easily affected by cold. This peculiar condition of the skin is a pretty good diagnostic mark of a nerve injury.

In these cases rest on a splint, opiates, local applications, time, etc., will bring the part round in a very large proportion of cases so that it may recover. It is known, also, very well that nerves that are cut have recovered their function after a certain time; that is, nerves of moderate size. It is one of the commonest observations that the branches of the facial on the face, cut so frequently in small operations about the face, entail at the time a great deal of paralysis, but it is not a permanent one. It is finally recovered from. This takes a long while,—four, six, eight months. Even the smallest growth or wen, anything of that kind, cannot be cut from out the cheek, from the side of the face or about the jaw, without cutting off some half-a-dozen or more filaments of the facial nerve. The muscles of expression of the face are so minute, and the changes which they undergo from want of innervation are so marked, that even these little incisions, destroying a few branches of the nerve, will give rise to a visible paralysis, and change of expression in the features. It is then important to warn the patient, who is to have a slight operation about the face, that he will have a temporary paralysis about the face for a little while, but that it will eventually recover.

Now after large trunks are cut off, unless the parts can be held perfectly still in apposition, their reunion is not so hopeful; but in these antiseptic days the stitching of the nerves together has been done with great success. It is said that you must stitch the sheath, or the neurilemma. That is very easily said, but it is very difficult to do with ordinary instruments and needles without involving some of the nerve filaments and cells in the sutures. In fact, I believe it is

practically impossible to stitch the neurilemma of the nerve and sheath close to the other divided end without more or less mutilation. Apposition of the ends, however, is what is needed. They should be snugly stitched together by antiseptic sutures. Put the limb on a splint so as to relax the nerve a little; dress the wound antiseptically; hope for union by first intention, and for union of the nerve.

The sensibility will not usually return for some weeks; but comes back very gradually as the nerve gets healed; and the nervous influence is re-transmitted across the space.

Partial cuts, then, will heal. Cuts of small nerves will repair themselves. Cuts of large nerves, as a rule, will not repair, unless they are sewed together by the surgeon.

Another class of affections and injuries of the nerves which are very troublesome is when the nerve has not been cut off itself, but happens to get tied down in a cicatrix. This is a very distressing class of cases. It may occur in the continuity of a nerve, in the brachial or sciatic, that cicatricial tissue gets formed around the nerve, binds it down, compresses it, makes strong and elastic adhesions, and the nerve is held in this way until it gradually loses its own nutrition, withers, becomes changed in tissue, and so finally loses its use and function permanently. Unfortunately this change is almost always accompanied with a great deal of pain; and, inasmuch as most of the nerves have sensation as well as motion as part of their function, the pinching of the cicatrix, while it destroys the motor power of the nerve, at the same time inflicts severe pain on the sensitive portion; so that the tying down of a nerve in the cicatrix is one of the commonest causes of persistent neuralgia, or pain in the nerves. This, of course, is all relieved by cutting open the

cicatrix, relieving the pressure, and sometimes by stretching the nerves, which may be done with blunt forceps.

Unfortunately there is another class of cases where the relief given is very doubtful indeed, and that is in case of neuromata, or nerve tumors. They are not nerve tumors in the strict sense of the word. They are rather fibrous growths from the sheath of the nerve, which expand into little fibromata, in and among whose elastic fibres the nerve fibres get entangled and squeezed, apparently; and, although it appears as if there was a growth from the nerve itself, it is really fibrous tissue entangling the nerve in it. These neuromata, if single, and occurring on single nerves, are curable; but when they occur in stumps, on the ends of divided sets of nerves, and occur in clusters, they are frequently incurable. The difference I do not know how to explain; but such is the fact.

Of the first class of cases is what is called the painful subcutaneous tumor. This means nothing more than a little neuroma, which is small, subcutaneous, and always implanted upon some cutaneous nerve. A favorite site seems to be on the peroneal regions about the fibula; also the arm. Wherever the cutaneous nerves are stretched pretty well over the bone there occasionally comes what is called the painful subcutaneous tumor, which is nothing more than a little neuroma upon a cutaneous nerve-filament.

These little tumors are peculiar. They can barely be felt beneath the skin. They are a little larger than bird-shot; are sensitive to pressure; and they are the seat of terrible neuralgia. The patient walks about for a while, or labors for a while, and as the day goes on this particular point begins to ache, and continues to ache until the limb is put at rest; and next day recurs again.

Now these troubles once recognized are perfectly curable by excision. The cure is complete; and there is no probability of a recurrence.

On the other hand, the class of neuromata which form on the divided ends of nerves in stumps after amputations are multiple, and not only very painful, but they are very difficult to extract without recurrence. This is a very peculiar condition, which, as I say, we are at a loss to explain. On the brachial plexus, for instance, after a high amputation of the humerus, in the stump there begin to be formed painful spots which grow worse and worse until the patient is driven to have the stump reopened, the diseased points sought for and removed. On opening the stump, there is found on the brachial plexus a bunch of neuromata looking much like a bunch of small grapes. They grow out from the terminal ends of the cut nerves in distinct little fibrous masses. Of course, the surgeon endeavors to remove them all. He cuts short all the stumps of the nerves as far as possible and allows them to retract into the tissues, and the part heals up; but, unfortunately, although this cures sometimes, it does not always do so; and recurrent pain comes on. The same series of changes take place higher up in the brachial plexus; and I know one patient where the pain finally went to the suprascapular nerve and the infrascapular, although removed about the axilla. This is a form of nerve affection which is not curable.

We see another class of cases distinctly curable, and that is where the end has got pinched in the cicatrix of the stump. You may have the bone a little too long. The flesh and skin of the stump are drawn tightly over the end, and then at some little nerve end you may have an exquisitely sensitive point, where, if you touch it with the

finger, the patient will scream out with pain, and which is always the seat of neuralgia. That is the case of a nerve imprisoned in the cicatrix, and that is curable. Cut away the cicatrix; shorten up the stump of the nerve, let it retract among the tissues, and the difficulty is removed. In view of this danger, it seems to be a very important point in amputating to make sure that the nerves are cut short; and that you should not allow them to appear in the stump. If they appear relaxed and hang out, you had better draw out the nerve as far as you can, snip it far up, and let it draw back among the soft tissues where it cannot come anywhere near the surface, or be exposed to irritating adhesions.

Chronic inflammations of the nerve itself in the form of multiple neuritis are sometimes operated on, and sometimes they are temporarily relieved, but not always permanently relieved. The trifacial nerve is especially the seat of these cases of great suffering; and special names are invented for the affection. The inferior dental branch and infraorbital branch are the most frequent; the supraorbital not so often.

These nerves have frequently been cut down upon; the jaw and bones trephined; nerves excised; and sometimes they have been excised and pursued even up to the foramina through which they escape from the skull.

Permanent relief has been given in a few cases; temporary relief in all cases, pretty much. But the trouble is apt to recur; and sometimes operation after operation is done without procuring final relief. In this case, of course, we must conclude that the trouble finally becomes central; is in the central nervous system; and that the seat of the neuralgia is beyond the reach of surgical interference.

Now, the most practical points about all this — the most

practical points surgically — are these: when a patient has had a blow, and, although the part looks well, when he insists upon it that it is always painful; that he is not comfortable; that the arm aches all the time, although nothing can be seen, you may conclude with great reason that a nerve has been bruised, and that he is having an effusion into its sheath that will not get well without treatment: that the treatment should be total rest, application of opiates, etc., until the effusion has gone. When you see a patient with these peculiar cranberry-colored knuckles and scaling off of the skin, you may conclude that, whatever that injury has been, a nerve has been badly damaged in some way. Then you would be mistaken in directing the treatment at all to the extremity of the hand and fingers where the trouble appears, but seek for the tender points above, and apply rest, splints, fomentations, etc., until you get the inflammation subdued. When you cut a little nerve on the face in doing any little operation, you will have more paralysis produced than you expected. You will be rather dismayed at the appearance of the face afterwards. You may, however, reassure the patient that the nerve will reunite in six to eight months. When a large nerve is divided, it will not, as a rule, reunite unless stitched together; and it is not possible to stitch the neurilemma without bruising nerve fibres; and that practically makes no difference, provided the operation is done antiseptically and the wound heals by first intention. Great relief can be given to nerves caught in cicatrices by dissecting them out, and shortening them. A single neuroma has only to be recognized to be treated successfully by cutting it out, and it always gets well. A painful nerve caught in the stump can be cured by cutting it out. It is a good

practical rule in amputating to cut the nerves short and allow them to draw back. The multiple neuroma is frequently incurable. We cannot promise cures. We can give temporary relief. The excision of nerves for neuralgia always gives relief lasting for months or years; but occasionally the trouble comes back beyond the foramina in the skull; becomes central; and the patient is the victim of permanent neuralgia beyond surgical aid.

Injuries of Muscles. — Now we pass to the injuries of muscles, which are very few in number. The principal one is rupture of the muscles. Bruises and hæmatoma, of course, we expect will absorb and get well without suppuration, as a rule. The rupture of a muscle is a very troublesome affair. The partial rupture is not of very great consequence, but a complete rupture entails entire loss of function of the part. The biceps humeri and quadriceps extensor femoris are frequent instances; the most common of all, probably, the plantaris. The plantaris is merely the analogue of the muscle which in the bear pulls upon the plantar fascia as he walks. It is practically of very little use in man; and yet, when it is ruptured, it gives rise to quite serious lameness for about ten to fourteen days. As you may remember, the muscle starts with a very fine muscular bundle at the condyle, then becomes developed into a thin, long tendon which runs along the sheath of the soleus and gastrocnemius by the side of the tendon of Achilles, and finally is inserted into the os calcis. This snaps and ruptures in violent efforts, sometimes. The patient is not aware of what has occurred; but is almost always convinced that he has been struck. Something has hit the calf from behind; is compared by him to the blow of a whip-lash, or sharp stick, and he feels lame; immedi-

ately begins to manipulate the calf, and expects he has been bruised. In a little while, if you see the case, you will find a minute extravasation of blood has taken place in the skin and is gravitating down along the sheath of the plantaris tendon. That may not come out until the following day, or longer, but shows itself plainly; and when you see it, it is quite diagnostic of the affection. Meanwhile, the calf swells, the ankle swells a little. The patient walks not at all, or with great difficulty. He preferably takes a cane or crutch; and the trouble lasts one or two weeks. Nothing can be done in the way of repair. The injury is irreparable. The extravasation of blood along the sheath of the tendon makes the diagnosis clear. The diagnosis is strengthened by the age of the patient. This accident rarely takes place before the age of forty-five to fifty; and preferably in women of lax fibre and rather fat; occasionally in men. It usually occurs in consequence of some sudden and unexpected exertion; such, for instance, as trying to get hastily on a horse-car; trying to get up on a very high step; missing the step; getting off of a curbstone and coming down into the gutter; and, as I say, it occurs only in a person whose muscular fibres have become degenerated, who is fat and lax; and the sensation is attributed to a blow from behind.

It is a good plan to treat it, because it gets well quicker. In the first place, if the patient is willing, he should lie still and have the calf fomented a day or two; a flannel bandage from the foot to the thigh applied, and kept on about two weeks. In addition to this, the patient must use crutches, or a cane. After about two weeks the trouble gets well.

Tearing away of the muscular fibres of the quadriceps extensor femoris from the tendon of the patella above

makes a complete disability, just as complete as rupture of the ligament below. The muscle goes up in a mass, and the patient is practically helpless with regard to standing, and especially with regard to extending the leg.

Rupture of the biceps humeri makes an equally great deformity; but is not so marked in the disability it entails, because we always have the other muscles, the brachialis anticus and coraco-brachialis, to assist, so that the function of the biceps is not so missed as the function of the quadriceps extensor femoris.

It is a question in my mind whether it is not justifiable in these cases, if seen early, to cut down upon the part antiseptically, and try to sew the fibres together, put the limb in a state of relaxation on a splint and endeavor to promote adhesion. As a rule, the trouble is not fully recognized; tearing takes place gradually. The patient does not seek the surgeon until some time has elapsed; then the contractility of the muscular fibres is so great and the muscle is drawn so far beyond its place that it cannot be got down, and the trouble is practically hopeless of remedy except by position and bandaging and time.

Tendons rupture occasionally, but not very often. The most familiar mode of rupture is when the patient gets caught by the fingers; generally children, boys, getting caught on a fence or pickets, and having the finger caught, are temporarily suspended by the fourth or third finger. That tears the muscle in the forearm, and out comes the tendon and muscle, the whole thing sometimes many inches in length, from the lacerated wound on the finger. These long tears of the muscles, of which there are a number of instances in the museum, are irremediable, of course. There is nothing to do but to extract and cleanse

the part, and try to make it heal antiseptically, having forever lost the use of that particular tendon. Repair is impossible.

Tendons slip out of place sometimes; slip off from attachments about the ankle, the peronei especially; and also occasionally, it is said, the long head of the biceps. This, however, is difficult to prove anatomically when it occurs; and it is perhaps not worth while to waste much time over it, as its existence even has been doubted. But the peronei about the ankle, and occasionally one of the ham-strings, slip out of place and have to be treated by bandage and apparatus to hold them in place.

The *Bursæ* are developed outside of the joints as a rule, little synovial sacs intended to relieve friction; and, as you know, they become developed by the use and friction of the part, insomuch that certain trades are marked by peculiar bursæ. The miner has a bursa over the olecranon, due to picking with his elbow raised so much against side walls. The bursa over the patella is the common one, as you know, which becomes inflamed and aggravated by work upon the knees, as in the case of women who scrub floors; and also largely in these later times, when hard-wood floors are used so much, in carpenters who work planing and polishing. The carpenter has what used to be called the housemaid's knee by this development of the bursa over the patella.

The only point we have to speak of in this part of the subject, in regard to bursæ, is their injuries. When they are wounded they give exit to an albuminous-looking fluid like the synovial sacs. They, of course, should be treated by cleanliness and rest, antiseptics, etc., until they can heal.

There are certain ones, however, which when wounded are extremely dangerous. For instance, there is a bursa de-

veloped about the semi-membranous tendon at the back of the popliteal space. This bursa is not very uncommon. It occasionally gets wounded, and unless treated carefully, entails serious consequences, because it very frequently communicates with the synovial sac of the knee-joint; consequently double care must be taken to wash out all dirt; cleanse and bandage it, and employ rest a good while, to avoid ill consequences.

The other class of bursæ which sometimes get injured, and sometimes are operated on surgically, are what are called ganglia, an improper name; they are also called sometimes weeping sinew. They form as little synovial sacs on the sheaths of the tendons at the wrist, especially on the extensors, sometimes on the flexors.

It is of the last importance to recognize a wounded joint and especially any synovial sac. The joints most frequently injured are the knee and elbow, especially the knee. The synovial sac of the knee is very large, extending far up above the patella. The punctured wound driven in above the patella is sure to injure it, and that is the favorite location for wound of the knee-joint. It may be a minute puncture. Nothing may attract attention to it unless we observe carefully, and then we shall see a little clear, white, opaque, albuminous-looking fluid is coming out, not like blood, not like anything else. This is a synovial fluid, and indicates puncture of the synovial sac; and it is extremely dangerous unless treated antiseptically and by rest, inasmuch as destructive synovitis is likely to come on, if any dirt gets into the sac.

XVII.

FOREIGN SUBSTANCES IN THE THROAT.

Where do they go? Most likely they go into the alimentary canal. Occasionally they pass into the trachea. What different symptoms do they produce according to where they happen to lodge? In other words, what is the differentiated diagnosis between a suspicion of a foreign substance in the œsophagus or in the trachea?

If in the œsophagus, we naturally have great difficulty and reluctance in swallowing. Moreover, there is rapid increase in the secretion of all the fluids which assist in mastication and digestion in the mouth — great flow of saliva and mucus, that is quite common. These effects are not produced if the foreign substance has gone into the air-passages. If in the air-passages, there is no difficulty in swallowing. There is not an increase in salivation. If the foreign substance is in the œsophagus, it catches on one side or the other. The patient always inclines the head sideways and forwards to relieve the tension of the œsophagus; so that the characteristic position is a little like that of wry neck, where a foreign substance is in the œsophagus. Stabbing pain on swallowing, reluctance to swallow, soon followed by inability to swallow; if inability to swallow, the saliva constantly drooling — that comes next in the stage. Soon after that, œdema of the throat, outside, under the skin; noticeable swelling and puffiness around the site of the foreign body. Peculiar position of carrying the head, saliva-

tion, inability to swallow and œdema — these seem to be the most marked symptoms when a foreign substance is in the œsophagus.

Now, on the other hand, if it has gone into the trachea, at first it produces intense symptoms of spasmodic croup. The foreign substance rides up and down beneath the vocal cords with each inspiration and expiration, strikes against the bottom of the glottis; produces irritation, spasmodic closure; and hence we have all the phenomena of spasmodic croup. The child appears to be suffocating. That passes off in a little while. The foreign substance drops to the bifurcation of the trachea, usually, and rests there; and beyond a sibilant, uneasy sort of breathing, there is not much indication of its presence. The characteristic position of the patient is rather upright and backwards, as they hold the head in croup, so as to lengthen the trachea, and give the best access of air. If there is any characteristic position, it is rather with the neck extended. There is no difficulty in swallowing; no salivation. If the foreign body remains, speedily bronchial secretion is excited, and necessity to expectorate comes on. That requires cough. Cough dislodges the foreign substance, drives it up and down against the vocal cords. There is then a repetition of the paroxysm of croup, which subsides again. I was once called to a case where a foreign substance was really the cause of the trouble, but the child was supposed to have the laryngeal stridor of spasmodic croup and nothing else, for several days and nights. Next positive bronchitis comes on; sometimes broncho-pneumonia. The child grows quite sick; goes through an attack of slight pulmonary inflammation, and then there is left chronic bronchitis, with frequent attacks of cough; every attack of cough bringing on an attack of

spasm of the glottis. We have, then, if a foreign body has been some time in the trachea, the symptoms of chronic bronchitis added to those of spasm of glottis; and the whole phenomena are somewhat like those of whooping-cough, for which they may be mistaken unless a careful observation is made. Fortunately, the child, if old enough, almost always says that it has swallowed something; or if not old enough, the majority of them are watched and seen to swallow something.

Once in a while one sees a case where the symptoms are mixed, and where it is hard to say where the foreign body has lodged. Subsequently, however, after operating and extracting the foreign body its position explains why its phenomena were so varied. When the foreign substance happens to get caught in the gullet, just behind the arytenoid cartilages, it provokes the fibres of the pneumogastric, and brings on spasmodic symptoms and difficulty of breathing; but it very rarely catches there. If you see a bi-vertical section made of the head and alimentary canal, you will find that the pharynx is a funnel-shaped cavity tapering to a point near the œsophagus. This point is just behind the cricoid cartilages; and at this point the constrictor fibres cease and the circular fibres begin. At this point there is a sort of purse-like constriction; and that forms a little ledge; and it is on that ledge that the foreign substance, if swallowed into the alimentary canal, almost inevitably catches; consequently, if the foreign substance has got into the throat, passed beyond the voluntary control of the palatine arches and cannot pass down, in nine cases out of ten it will lodge on this little ledge, just opposite the cricoid cartilage, and preferably on the left side, because the œsophagus inclines to the left in its passage down into the thorax. In this particu-

lar case I spoke of, the foreign substance did not go so far; and irritating the back of the larynx and arytenoid cartilages produced the symptoms of difficulty of swallowing and difficulty of breathing; but ordinarily the substance that is lodged at the commencement of the œsophagus produces only the symptom of difficulty of swallowing.

There is another class of cases in which not only difficulty of breathing is produced by a foreign body in the air-passages or in the œsophagus, but even suffocation and death. Such is the case in which a bolus of soft food is swallowed hastily, drops through the pharynx, lodges on this ledge, and there is too big to pass, and necessarily compresses the back of the trachea. The back of the trachea is devoid of cartilage. It is quite conceivable that a foreign body may compress there and produce death by suffocation. This is the ordinary way in which deaths are occasionally reported as occurring while the patient is eating. The patient is eating carelessly some large mouthful of soft substance ; jumps up ; throws up the hands; falls to the floor; turns blue; ceases to breath, and dies. It is due to a bolus lodged, not in the trachea, but in the œsophagus, and pressing in on the back of the trachea. If assistance can be efficiently rendered at the moment, and a probang were at hand, so that the substance could be pushed down a little further, it would drop lower down into the œsophagus, and the patient would be saved.

The cases where foreign substances are inhaled, so to speak, into the air-passages, and are large enough to produce death by suffocation must be excessively rare, if they exist. In proof of that is the fact that so many foreign substances have been extracted from the trachea which have not caused death at the time of their first being drawn in; notably coins

as large as the English sovereign, copper pieces and silver pieces have been carried into the trachea, producing spasm, but not immediate death.

So much for the essentials of diagnosis.

Now, in order to complete this part of the subject, we will follow up a substance supposed to have gone into the œsophagus, before taking the other class which have gone into the trachea. Most of them go down. A few of them lodge temporarily; and then after a few efforts, by swallowing a bolus of bread or drinking a draught of water, are swallowed.

Still another class are vomited up. The patient passes the finger down the throat and the tickling produces nausea, regurgitant action of the œsophagus comes on. The foreign substance is thrown up with the vomitus and the patient relieved. A considerable percentage of substances swallowed never get as far as the back of the cricoid cartilage, but lodge in the pharynx. Those are generally extracted through the mouth; many of them by the finger of the surgeon or physician when he arrives. The best way is to put a wedge between the teeth: put the finger in as far as possible to sweep around; and in very many cases bones, or fragments of meat containing bones in them, foreign substances, like pins, hair-pins, shawl-pins put in the mouth of children, are readily detected, if they have not gone far beyond the palatine arch; and can generally be brought out by the finger, or reached by the finger, and extracted by the other hand with forceps. A large class of substances go into the œsophagus, lodge temporarily, but pass down and disappear from view; yet they give the patient the sensation and the belief that they are still in the œsophagus. That is the hysterical class of cases. They are more numerous, I think, than the real class

of cases. Such a patient will come in and say he is quite sure he has a bone in the throat; that he got it in two to four days before, perhaps; and he is quite sure it is still there. You are quite sure that it is not there by the mildness of the symptoms; for no human being can tolerate a sharp substance in the œsophagus three days without producing intense local and constitutional symptoms. In such cases as these it is better, usually, to pass the bristle probang down gently, and then withdraw it. You find nothing. The moral effect is marked; and it needs only the effort of faith on their part to get them well.

Foreign substances which really lodge at the top of the œsophagus and do not become dislodged either upwards or downwards are then not very numerous; and when they are there they produce such a marked series of phenomena that there can be no mistake as to their presence. If then the patient with a history of having swallowed something he thinks has not passed, after two or three days presents the characteristic attitude, total inability to swallow, drooling of saliva and especially commencing œdema of the neck, we feel that something must be done, at once, to relieve him.

Let us consider for a moment what takes place if they are not relieved. Numerous clinical histories have been collected, and quite a large series of experiments made on dogs, by inserting foreign substances into the throat and leaving them. These experiments have shown that the foreign substance which remains beyond the third day almost always, if it remains unmoved, provokes abscess and eventual perforation of the wall of the œsophagus, and the various consequences that may follow; and a periœsophageal abscess may be behind the œsophagus, may be at the sides, may be in front. You will remember, from the arrangement of the cer-

vical fascia and the looseness of the tissues on which the pharynx, larynx and trachea glide in the action of swallowing, that there is really no barrier stretched across between the mediastina and the spaces of the neck ; and if an abscess forms, there is nothing to prevent its gravitating down into the thorax and eventually penetrating the pleura; sometimes perforating the large vessels, and leading to death from hæmorrhage ; frequently penetrating the air-passages and causing death by suffocation ; and, in some rare cases, where the patient lives long enough, and the abscess forms behind the œsophagus, leading to denudation of the tissues over the bodies of the vertebræ, and positive caries of the spine itself. Usually, however, where the foreign substance remains long enough to provoke abscess, the case goes on to a fatal termination in the course of a week, or ten days; and autopsies have proved that such is the usual result, and such the destination of the foreign bodies. A foreign substance left in, means abscess; sometimes coming on in three or four days; and death taking place in one or two weeks, in the majority of patients.

What then shall be done? Extraction through the natural passages, through the mouth, is of course the first and most natural idea which would occur to one, and it has often been practised with entire success. Loops, snares, forceps and various devices are used to slip down into the œsophagus and to catch the foreign body and bring it up. The snares and nets have often brought up coin; the loops and forceps have often brought up substances like bone or pins. Great care and gentleness, of course, have to be used in manipulating and in extracting; for otherwise we shall push the edge or point of the foreign substance, if it happens to be sharp, through the walls of the œsophagus, and make that

perforation which we dread. It is quite possible, also, to make a retropharyngeal abscess and perforation by the rough use of even a simple probang. So that in that class of substances which we judge it is safe to push down into the stomach, where there is a bolus of soft food or some vegetable substance, something not sharp and hard, or even a coin, such substances as that, we may push down by a probang with a sponge on the end; but we must use care and gentleness, especially in that point behind the arytenoid cartilages where the pharynx first enters the œsophagus and lies like the finger of a glove; we must be especially careful there, or we may perforate the back of the alimentary canal, and lead to the retropharyngeal abscess, which would not have been caused by the foreign substance. One or two instances of death have occurred in that way. Pushing down or extracting through the natural passages is to be attempted, if the substance has not been there too long; but if the substance has lodged there as long as the third day, and œdema of the throat and threatening abscess is already imminent, it is questionable whether other methods had not better be used.

A few years ago there was revived and brought back from India an instrument which has been of the greatest assistance in extracting foreign bodies, called the bristle probang; it has a little collar of bristles attached to an ordinary probang sliding in an elastic catheter; when you pull out the probang, it forms a circle of bristles, and sweeps the œsophagus, and frequently brings out the foreign substance. Care must be taken to see that the bristles are all perfect; that their rounded ends are turned in. All parts of the instrument must be thoroughly examined and felt, at first, for fear that something may break off in the œsophagus in the struggle of

the patient, while withdrawing the instrument. It is passed down gently until you are sure that it is near the cardiac orifice of the stomach; then unfold the little bristles, and withdraw slowly and gradually; and in very many cases the foreign substance is brought out entangled in the bristles. Blood almost always follows, whether the foreign substance is brought up or not. There is a little scraping of the mucous membrane, which makes it bleed. The patient is sore for a few days afterwards, whether a foreign substance is there or not; but that soreness soon passes off. Carefully used it is a harmless instrument; and it is so reliable that it has probably diminished the chances of any one's doing an operation for a foreign body in the œsophagus very much.

A substance may go into the throat of such a nature that you do not dare to push it down; and having been there so long that there is œdema and fever and other evidences of commencing infiltration, you do not feel it is safe to manipulate; what is left to do in order to save the patient's life? Obviously to try to remove it by external incision in the neck. This course would seem to be so plain that it is quite surprising that although it was done early in the eighteenth century, it fell totally into disuse, and it was not until about 1842 or 1843 that it was revived again; and then with timidity; and not until about 1868 that it was done with frequency.

Up to 1868 I could collect only twenty cases; but at the present time I can find one hundred and fifty-nine; so that in the last twenty years one hundred and thirty operations have been done; and previous to the last twenty years, twenty operations had been done. This shows the immense progress the operation of œsophagotomy has made since it was found that it could be done safely. What was the

bugbear in the way? People were doing quite as dangerous operations about the throat long ago. The older surgeons back to the time of Velpeau and the elder Dr. Warren did the most terrible operations with safety, and without ether. The reason was the belief that, if the œsophagus was opened, it would never heal; and that a fistula would be established which would forever render the life of the patient miserable; that fluids of all kinds would be constantly regurgitating through the wound in the throat, that an œsophageal fistula would be a permanent thing; and that, if the œsophagus was opened by the passage of nutriment and the movements of deglutition, healing would never be brought about. It was then the fear of a fistula, more than anything else, that interfered with the progress of the operation. Now, however, we know that that fear is groundless; and experience has demonstrated that wounds there will heal, and without sewing also; will fall together and heal by granulation, without sewing, perhaps faster than when they are sewed up; and a good many operators, of whom I am one, prefer to do the operation without sewing; and it heals exactly as well. So, also, in a number of cases in which I have opened the pharynx, and made large openings into the throat about the region of the tonsils, the back of the pharynx and the arches of the palate, for various purposes, in no case has there remained a fistula; in no case have they been sewed up; and in many cases there has been no leak of food from the first moment after the operation was done, the action of the muscles of the pharynx closing the orifice. In the œsophageal cases I have had healing take place, always, in about two or three weeks, and never longer than four weeks. You need not imagine if you happen to incise to remove a foreign body that you will not have a temporary fistula, for you will. If

you open the passage as low down as this, the first efforts at deglutition will be followed by the spouting out of large quantities of fluid through the opening. Gradually, as the patient goes on day after day, the quantity grows less and less; and from being a stream it becomes drops, and presently ceases altogether.

The fear of a fistula being dismissed, there is really nothing which should render the operation for extraction of foreign substances through the œsophagus any more difficult or dangerous than the ordinary operations of surgery. I say any more dangerous, with good proof, because in the cases I collected myself, a good while ago, the mortality of operated cases was just about 25 per cent.; and in the table which I have just taken from Dr. Ashhurst, where there are 159 cases, there are 24 deaths, or scarcely one-sixth; so that it may be safely said that in the cases of foreign substances, where it is necessary to operate, three-fourths get well, and one-fourth, at the most, die. On the other hand, if let alone, it is almost sure that 100 per cent. will perish. Moreover, in the twenty cases I collected it is instructive to know, that the four or five which terminated fatally after operation, had been deferred until abscess had already formed, and secondary absorptions, as proved by the autopsies, had taken place. As in the case of strangulated hernia, after fair attempts have been made to remove the foreign body by the natural passages, the sooner such an operation is done the safer for the patient; and the quicker the healing.

The operation is done by an incision similar to that for tying the carotid artery; and the sheath of the vessels is found but not opened; the edge of the sterno-mastoid, of course, is found, and then the vessels in their sheath, with

the pneumogastric; — the sterno-mastoid is drawn outward; and the larynx, mylohyoid muscle and the long muscles attached to the larynx are drawn inwards; and gradually we pick our way down to the œsophagus. There is a place left by nature, near the cricoid cartilage, through which we may pick our way down until we may go to the prevertebral fascia, if we wish. The superior and inferior thyroid arteries and superior laryngeal nerve, and the recurrent or inferior laryngeal nerve, are the things to be looked out for. The first three are easy to look out for; the other is not. It is important not to wound the recurrent laryngeal nerve: it controls the sensibility of the larynx; and any impairment of its fibres is a certain injury to the vocal cords. If we avoid that wall of the œsophagus which lies near the trachea, we shall not wound the nerve; hence the incision should be made on the postero-lateral part of the œsophagus; that is, on the side towards the rear of the œsophagus and towards the vertebral column. It is very easy to get down there; then you put in the finger and see if you feel any foreign substance through the walls of the œsophagus. Usually you cannot. Then you find the only difficulty of the operation, and that is to open the œsophagus. The œsophagus is like the collapsed finger of a glove: lies in between the trachea and the vertebral column; nothing to stretch it. You are forced to introduce something as a guide. You pass a long catheter or stomach-tube into the mouth; into the pharynx and down past the point of incision. That brings the œsophagus up into view. You can then cut upon the posterior surface, upon the catheter, and make an opening, and then withdraw the catheter and enlarge the opening at your pleasure, and hold the sides open, and search for the foreign body.

Sometimes it is opposite; sometimes below; sometimes above. It is extracted. There is no hæmorrhage. That is all, I think. There is nothing more to do, except that I should advise that the patient have absolutely nothing to eat for twenty-four hours; not a drop of any liquid or food. Thirst may be allayed by watery enemata thrown into the rectum; by allowing the patient to bathe his face and hands and wrists, which is a great comfort when feverish; and nothing should be given for the first twenty-four hours. Subsequently to that I have been in the habit of letting the patient swallow such liquids as were simple and homogeneous; first water, and then milk; or, if they wish it, strained beef-tea or broth. Iced milk is very grateful to the patient. The patient will sit up in bed and drink with perfect freedom and ease; get about one-third of the milk into the stomach, and the rest will pour out through the wound in a perfect jet. Why not give the nutriment the first twenty-four hours? To give the parts time to glue together a little, so that the fluids may not trickle down between the layers of the tissues and give rise to deep cervical abscess. Why not feed the patient with the stomach-tube, instead of allowing anything to pass out through the wound? You may do so, if you wish. I have not thought it necessary. You must be aware, if you are going to feed the patient with the stomach-tube, that the tube has got to be passed below the level of the wound. Now this requires the stomach-tube to be passed a good ways. It requires you to steer it by the edges of the wound without irritating or making the parts bleed; and that has to be done three or four times in the twenty-four hours. I think this would interfere with the healing of the wound more than letting it alone. Some operators do one way, and some the other.

The essential thing is to make the diagnosis; do not wait too long. Get down to the œsophagus; stretch it, and cut in on the posterior side; extract the foreign substance; and, if the case has not been suffering too long, it will recover, almost certainly; at any rate, in three-fourths of the cases. The tolerance of nature in healing these cases is very remarkable. That was well instanced in a case of mine, which I always mention because it was very remarkable. The patient was a very stupid, drunken fellow, who, the first time, got a pin in the throat, and I did the operation; opened the œsophagus; removed the pin; kept him in the hospital three or four weeks, until he ceased to discharge any fluid through the sinus; and until the cut was a mere little line of granulations, almost healed; then I let him go home. He promptly improved the opportunity to get drunk again; and then tried to eat some rough meat with bones in it; and got a piece of it in his œsophagus, but coughed it out. It did not lodge there and he did not require any other operation. By this occurrence he burst open the whole wound, and came into the hospital with a fistula thoroughly established. It looked discouraging with regard to healing; but after a month or six weeks it closed entirely. That shows the power of healing, contrary to the old idea that it was not safe to touch these cases at all.

FOREIGN BODIES IN THE AIR-PASSAGES.

The symptoms I have already described. They may be retained there a long while without killing the patient; many weeks; sometimes several months. Some substances, which are apparently innocuous when they are drawn into the trachea, afterwards change in a way to destroy life. It is very curiously the case with the vegetables like beans

and peas. Beans and peas are favorite playthings with little children. They are apt to get them into the nose, or mouth; and if the child has a bean in his mouth and suddenly his attention is distracted, or it laughs or cries, and opens the mouth and inhales, the bean slips down past the guard of the epiglottis, and gets into the trachea, and lodges at the crossing of the bronchi; there produces the usual phenomena, but is not enough to obstruct respiration; but after twenty-four hours it excites secretion, swells, and leads to death from pneumonia, or atelectasis of the lung. Bear in mind that foreign substances always obey the law of gravity; and that any substance which has a large end and a small end will go down large end first. This is especially true of shawl-pins. The shawl-pin is an even pin all the length, with a wax or glass head. When coughed up and down the point is constantly cutting and pricking against the bottom of the larynx. Such a pin I removed from the trachea of a child after it had been in six weeks. This child had suffered a good deal from chronic bronchitis.

The symptoms are marked. What is the relief? The old remedy was to hold the child up by its legs, and to pound on its back, — occasionally, effectually. It was dangerous, however. The child is held upside-down, screams and cries, the substance drops on the glottis, spasm of the vocal cords is produced. Either it relaxes and the foreign substance comes out, or the child chokes to death in a very short time. The better way probably is not to attempt such a thing as that, unless the means for doing tracheotomy are already at hand.

Opening the trachea is the only way to get at the foreign substance; and in this condition of things the child, not

being in a state of profound dyspnœa except occasionally, it is perfectly proper and easy to give an anæsthetic — chloroform or ether. The child narcotized; the trachea opened in the usual manner; the sides are held open with hooks, and efforts made to find the foreign body. The foreign substance is sometimes thrown out in the gush of air that follows the opening of the trachea; and the substance occasionally is lost. If it is not expelled, it comes up into sight and disappears again. This cannot be the case with a substance which is impacted. Take a bean which has swelled. Symptoms would persist; no foreign substance would be seen. Nothing would appear. Then we should search the trachea with delicate curved forceps; and we can generally make out whether the two halves of the bronchi are clear or not. This failing, the next resource is to leave the trachea open; but not to put in a trachea-tube which would interfere with the expulsion of the foreign substance. The trachea must be fastened open; say, put a stitch opposite on each side, with two elastics attached, and fasten about the neck of the child; and carefully watch in order that nothing bad takes place; because you will remember that the child can breathe with its trachea held open in that way perfectly well as long as it keeps the head straight and lies on the back; but when it turns on the side everything shuts; therefore it has always seemed to me not so philosophical to do tracheotomy, and have the child treated without a tube, as it is to put in the trachea-tube. Excessive care in nursing must be had afterwards to prevent the child from turning the neck to one side, and suffocating. For these foreign substances you may sew the trachea open, and have the child watched, day and night. Many cases have occurred in which the foreign substance has been

expelled during the first few hours after this has been done. Finally the foreign substance has been found lying on the pillow, where it had been expelled. After this, what? It may be safer perhaps to leave the cut in the trachea open, or perhaps put in a tube, for a day or two, until any chance of œdema of the glottis has gone by; and then the wound is allowed to granulate and heal, which it always does with readiness.

The operation of tracheotomy itself. There is no need to describe it. You see it done. You probably will all have an opportunity to practise it, sooner or later. The important question is, what are the symptoms in the patient; no matter what the disease is, what are the symptoms in the patient which make you think now is the time to do it? We all know it is safer to do it early than late; that prolonged difficulty of inspiration and expiration; prolonged croup; prolonged spasm of the glottis, lead to changes in the air cells of the lung which render the child less liable to recover after tracheotomy is done, if done late, than it would be if done early. The air cells get distended and stretched, precisely as they do in the case of the man who is constantly blowing upon wind instruments; who fills his chest and lets the air out slowly through the holes of the wind instrument to produce certain notes. It is well known that pulmonary emphysema and dilatation of the air cells is a common affection in a person who spends his life in blowing the flute, or clarionet, or cornet. A similar condition seems to be produced, rapidly, in the delicate air cells of the young child, after they have been having this forced retention of air in the chest from imperfect respiration through the chink in the vocal cords; hence the importance of doing tracheotomy in membraneous croup, or diphtheria, early, rather than late.

Now there are certain symptoms of what we call dyspnœa, or difficult breathing, that come on, that are very significant. I would not call your attention to those which are so marked that any one who looks at the child would say "it is suffocating and near its death," when its nails have become lead color; when the complexion is slate-colored and blue; when the respirations are sighing and irregular and very imperfect; and when the child is in a state of stupor from carbonization of the blood;—any body could recognize that condition, and, generally, then it is too late to do any good at all. The symptoms which are significant are these,—great pallor; pasty look of the face? constant restlessness; extension of the head and neck backwards to lengthen the trachea; croupy breathing, of course; retraction in the space over the top of the lungs, behind the collar bone; still more marked retraction at the epigastrium. Uncover such a child gently, and see and watch his breathing. You will find the intercostal spaces drawn in at every attempt to inspire; the thorax thrown out with immense force; retraction then of the abdominal muscles; retraction of the supraclavicular spaces; throwing back of the head; restlessness; pallor; a croupy sound, are the most prominent signs. When this class of symptoms are persistent: after a little watching, if you look carefully at the history of the case and find that they have been developing slowly a few days; that the voice has gradually become indistinct; that membrane may or may not have been seen on the tonsils; that all the symptoms point to a permanent obstruction in the larynx from some cause;—then is the time to do tracheotomy, or intubation, if you prefer that method of operating.

XVIII.

WOUNDS OF THE FACE.

Wounds of the face open up the whole subject of plastic surgery. The essential point is, that in every operation, the skin that has been cut and torn away should be replaced, and preserved, if possible; for a very slight scar and loss of substance may make quite a difference in the facial expression. Thorough cleanliness, careful matching, sewing up with fine thread and fine needles. I think you have noticed when an amputation stump, or breast, which has been excised, has been shown as a fine result of first intention, a fine even scar which finally sank away into a white line, but on either side of it a long row of very conspicuous stitch-holes; and they are slower to fade away, dimple the skin, and draw it in, making more marked scars. This, however, in the breast makes little difference; but on the face it makes a great difference; so that the finest sewing must be done, or the buried suture used, so as to avoid so many conspicuous punctures.

A large class of operations used to be done to repair the nose, when it was lost. I think surgeons are becoming rather more discouraged about these operations, the restoration of the nose. It can be restored by flaps taken in various directions; but to restore its shape and its color is almost impossible. You generally have a flat, deformed, soft nose, with a very pale color; and it is scarcely less conspicuous than the hole it was meant to cover; consequently, unless you have to operate on the nose for the extermination of active disease

going on, it is a question whether it is not better to advise the patient to wear a mask over the nose, than to do a plastic operation on a large scale. The *papier-maché* noses which are made are extremely good, and can be replaced when they wear out, without much expense.

On the eyelids and lips plastic operations are of great im-importance, especially to avoid extreme drawing down of the lower lid leading to constant flow of tears over the cheek, to gradual change of the inner surface of the lower eyelid from its long exposure, and to danger of ulceration of the cornea from long exposure to the air; so that every resource of grafting or turning over flaps should be practised about the lids; also about the lips, where much can be done.

It is quite a common thing for foreign bodies to be put in the nose and ears by children. One should suspect in the case of a child who is supposed to have a polypus in the nose that he has instead a foreign body. It will prove to be a foreign body in a large percentage of cases. The child has inserted it unseen; is too young or afraid to tell of it. It remains caught on the turbinate bone, produces ozæna, filthy discharge, and is supposed to be a polypus. I say this to impress on you the importance of very thorough examination before any operation is undertaken in the child's nose. The foreign body, once found, can be easily extracted in a variety of ways—with the hook or snare; or, if necessary, by cutting up the ala of the nose by a simple incision; turning it one side; taking out the foreign substance; the subsequent scar is almost nothing.

In the ear the foreign bodies are not so often put in, as they exist in the form of some living creature; either a little bug or a fly, an insect of some sort. There is a very simple expedient to relieve the distress which these insects occasion,

immediately, which is harmless; and that is to pour in, or inject, either oil or melted mutton-tallow, and allow the latter to set in the ear. It does so in a very few minutes. The insect is imprisoned and killed, and can be syringed out and extracted at leisure. I speak of this as preferable to water, because it is more effectual. You will hardly realize the intense agony and almost mania inflicted on a person by the presence of an insect in the ear which is free to buzz on the drum. The torture is terrible; and speedy inflammation is set up, unless the insect is removed. It is easier to destroy the insect in this simple way than to search for it while the patient is in distress.

SUICIDAL, OR HOMICIDAL ATTEMPTS TO CUT THE THROAT.

The person who attempts to cut his throat, in the majority of cases, cuts too high to destroy life. A large proportion of the cuts are directly beneath the chin; and, if they go deep enough, open the floor of the mouth. The cut is directly between the hyoid bone and the chin usually; next between the hyoid bone and the top of the larynx; and next opening the trachea. Homicides occasionally seize the victim and cut the throat so thoroughly that a simple transverse cut divides also the vessels; but a suicide rarely divides the vessels; they lie so deep, descend backward so rapidly as they go down the neck behind the sternum, that they are rarely reached by the ordinary transverse cut.

The danger of the ordinary cut throat consists in the effect it is going to have upon the breathing, and upon the chink of the glottis, either by hæmorrhage, or by suffocative œdema. All cuts above or through the larynx, above the level of the chink of the glottis, are dangerous in the consequences they may bring to the glottis itself. The vessels

cut are usually small. The nerves which are reached by a transverse incision are few in number, and only terminal branches; and were it not for the chance of trouble taking place in the breathing apparatus subsequently, the injuries would be very rarely fatal.

However, the person sometimes cuts lower down, and cuts below the vocal cords; then he is no more in danger of suffocation than in the operation of tracheotomy; and the cut low down is harmless as regards the dangers of dying of dyspnœa.

The important point in regard to cuts high up is that they should not be closely sewed up without allowing some chance for drainage, and preventing the chance of infiltration into the larynx and the glottis: hence to sew any wound in the throat, which has penetrated deep enough to open the air-passages, is not good surgery. The parts should be approximated without stitching, and secured by a bandage. The wound will heal by second intention, and do very well. Meanwhile, we have entire security; for if the wound is not sewed, we have control of the breathing apparatus.

There are other cases where the passages have been opened above the vocal cords; where the cuts are very deep; and where it is wiser in the beginning to do tracheotomy, and let the patient wear a trachea-tube, rather than to risk anything that is going to take place from injury inflicted on the larynx and vocal cords. After tracheotomy, it is perfectly proper to draw together the wounded parts; wire together the larynx, and try to make the wound heal by first intention; but you must be sure, as regards the chance of suffocation, before you adopt any of these measures. Either leave the wound open, or do tracheotomy as a preventive measure. A few of these patients die of shock; but very

few. Almost all the suicides, after the commission of the act, come to themselves and wish to recover; and the majority of them do recover, unless the wound has gone so deep as to involve the pneumogastric, or the large vessels; or to lead to some subsequent abscess, or burrowing cellulitis of the neck. The cut of the pneumogastric is usually fatal by producing a slow form of pneumonic consolidation in the lung supplied by the wounded nerve; and the patient usually dies of this complication. Wound of the carotid artery is immediately fatal unless it can be secured at the moment. Wound of the jugular vein is not infrequently recovered from. I mean, of course, the internal jugular vein; for the external vein is a vessel not very dangerous to wound. It was the one formerly selected for venesection in children, when venesection was practised. It is easily secured and not very large.

INJURIES OF THE ABDOMEN.

Cuts and stabs and perforations of the abdominal walls are liable to be dangerous irrespective of wounding the viscera. The dangers are two. One is immediate; and the other is subsequent. Both these dangers can be classed under the name hernia. The immediate danger of hernia is that the wound gapes a little, a little bit of omentum gets forced through the wound and slowly emerges from the abdominal cavity under the peristaltic movements. You will be surprised to see through how small a puncture a large piece of omentum will be extruded on to the wall of the abdomen; and this may become strangulated and make trouble if it remains. The proper treatment is to cleanse the part thoroughly, carefully enlarge the wound, and sponge out the cavity, and restore the omentum into the abdominal cavity, and to stitch it up. Now comes the subsequent dan-

ger, which is of hernia after the wound has healed. You can hardly cut through the strong fascia of the abdominal muscles in any direction without the risk of subsequent ventral hernia in the scar. The wound heals by cicatricial tissue. Unfortunately it does not seem to possess, in this region, that great power of contraction that it has in the burn; or that cicatrical tissue has in the perineum after an injury to the urethra. It is here a soft tissue constantly moved and stretched by the use of the abdominal muscles, and is very apt to yield and gap open after a few months, and give rise to a hernia. In this case we have but one resource. We may try, if we wish, to reduce the hernia; cut down and make a fresh incision, and see if we can get a stronger union than was there before. This is of questionable success. If we do not attempt that, the only other resource is to apply the ventral truss for a hernia, which will keep the bowel in. I allude to this, particularly, because I do not think it is strongly enough insisted on, that whenever the abdominal muscles are cut through, the chances of subsequent hernia are very great indeed.

Since the introduction of antiseptic surgery the peritoneal cavity has been opened with impunity, compared with past times; and a new name has been sought from the Greek to describe the operation, the name of laparotomy; and this operation is done for a great variety of purposes. There are two or three of the more prominent reasons why it is done that I shall speak of now. One is for what is called stoppage of the bowels. Of this there are two principal forms: one is twist or volvulus, and the other the folding in of the gut into itself, sometimes called intussusception.

Now it may make but little difference in the prognosis which of these two forms of trouble exists, and either of

them may call for operation. The diagnosis between the two may be important and useful as guiding to the proper treatment by operation. We may say in general terms that intussusception is much more common in the child than in the adult. The peristaltic motion is more powerful in the child; the mesentery is more free. The folding in of one portion into another is much more apt to occur in the young child than in the adult. Hence the age of the patient influences us in making the diagnosis. The subsequent symptoms produced by the stoppage also guide us a good deal to the diagnosis. In either of these events, whether intussusception or volvulus, immediate stoppage of peristaltic action occurs above the seat of obstruction; the bowels cease to move, and accumulation of gas takes place; but in the twist or volvulus this is absolute and complete from the beginning; the patient has generally no desire to have any discharge from the bowels, either of wind or other substances, and makes no effort. Everything seems to be dead and still. On the other hand, the child that has an intussusception has, for a day or two after the accident, a constant desire to move the bowels, and is constantly making straining efforts at stool. Moreover, these efforts do produce something. They produce serum and stringy mucus, and occasionally a little blood; and the child is making incessant attempts for the first day or two after the onset; and this guides somewhat to the diagnosis between twist and intussusception. I should say that the diagnosis between the two is important in this way, that the intussusception is not so hopeless as the twist. Nature sometimes, though rarely, cures the intussusception, either by retracting the bowel back into its normal place; or, as is more frequent, by causing it rapidly to adhere, causing the inner piece to slough, making union of the two ends of

the intestine, and discharging the sloughing piece through the natural tract and through the anus, by the efforts of the child itself. This sometimes occurs in the course of the second week after the intussusception; though rarely. So in the treatment of these two affections our first efforts in regard to intussusception should be to restore the bowel to its normal condition; and if we had made the diagnosis of volvulus or twist we should know that the treatment we are going to use to push back an invagination would be worse than useless in volvulus. We use large enemata of fluid or air, and invert the patient, and try to promote retro-peristalsis, to push the bowel back into its normal place. This would be worse than useless in twist. In twist or volvulus the seizure is immediate; pain intense and localized; efforts at stool are none whatever. Peristaltic motion soon ceases absolutely. The abdomen is like the abdomen of the dead person, except that it rapidly becomes distended with gas above the point of stricture. The high temperature produced by this state of things goes on from three to five days. Generally by the fourth or fifth day the symptoms undergo an apparent amelioration; although this is entirely deceptive, and does not mean that the patient is going to get well. In other words, the temperature falls; pain ceases; no passage takes place from the bowels; no wind is passed; the size of the bowels may not recede; but the temperature falls, and his pain ceases. Meanwhile the pulse flickers and grows more rapid; the capillary circulation is a little obstructed and dark, and he dies usually without suffering; and the signal of the loss of pain and dropping of temperature on the fourth or fifth day means that sloughing of the part or mortification in the abdomen has taken place, to be followed by death.

In these cases we have some hope, that if nothing else has succeeded in relieving the patient, opening the abdominal cavity and seeking for the cause of the obstruction may do so ; that an invagination, if not too old, may be reduced ; or if irreducible, the two ends of the intestine may be cut off and sewed together, thus imitating the process of nature, which is trying to slough off and unite the pieces : that a twist may be relieved by dividing adhesions.

If then we are thoroughly convinced that other measures are failing ; that the diagnosis is reasonably clear ; when the second or third day has arrived, it is good practice to open the abdominal cavity and see if we can give relief. Meanwhile, if the diagnosis is uncertain ; if the time has not arrived when you think it is safe to open the abdominal cavity ; a good deal can be done in the way of relief by medicine ; and certain things are very comforting to the patient, and usually check the progress of inflammation. These are, in such violent cases, the free use of opium ; and the application of cold, or warmth, to the abdominal wall. Usually warmth is most grateful to the patient ; but if cold is grateful, and can be kept up by means of the cold-water coil or ice-bags, it no doubt is good treatment in checking congestion and effusions. It would be obviously improper, perhaps useless, in these cases where we are pretty clear that a twist or invagination has taken place, to give cathartics. If grave doubts exist as to the cause of the obstruction ; if we feel that it may be a temporary stoppage of peristaltic action from spasm ; or cessation of flow in the gall-ducts ; or from impaction of fæces ; then cathartics are proper remedies to use. The question then arises, what cathartic ? The most useful in allaying the irritability of the intestine are two in number. They act very differently. One, the well-diluted

saline solutions of any kind; epsom salts; sulphate of soda, etc., which can be given in small and repeated doses, and produce a large flow of serum from the mucous membrane of the alimentary canal. The other agent is also extremely valuable, because it acts quietly and smoothly; and in the end, if the obstruction is removable, it is irresistible; and that is castor oil; not given in the ordinary way; but in minute doses at short intervals; a drachm every four to six hours, thereby the patient getting from one-half to one ounce every twenty-four hours; and this persisted in, two or three days, will certainly, in the case of ordinary obstruction, if the oil is retained well on the stomach, produce, sooner or later, thorough fæcal evacuations, and without disturbance.

Then we have that large class of cases where the trouble begins by inflammation in or about the appendix, and head of the cæcum; sometimes behind the peritoneum; sometimes within the peritoneum; sometimes beginning by perforation of the appendix; and sometimes, apparently, by cellulitis in and around the appendix, not followed by perforation. It is well-known that perforation of the appendix, with a throwing out of some hard mass into the peritoneum, is not necessarily followed by fatal peritonitis; because a localized peritonitis is immediately set up in a large number of cases. The foreign substance becomes speedily encysted; walled off from the general peritoneal cavity; and finally terminates in the formation of an abscess, which may, or may not, have a fatal result, if left alone. If the adhesions are strong enough, it may seek an opening through the abdominal walls, or lumbar region; or again, as is more frequent, it not seldom finds its way down into the pelvis, and forms a pelvic abscess, and finds an exit, in safety in some cases, in the rectum or vagina; so that perforation through a small open-

ing, letting out a small quantity of fluid matter, is speedily followed by walling in of the offending portion by rapid adhesions. You, perhaps, in seeing some of the results of operations on the appendix, may have seen how rapidly adhesions take place between the coils of intestine, when there is an opportunity to do so.

The question in these cases is very doubtful whether immediate laparotomy should be done, or whether we should wait. Very many patients recover without operation. It is true that they are left afterwards with the chance of another attack of the disease; but it is also true that an operation, which is done, leaves them necessarily with adhesions; with subsequent impairment of the mobility of the parts; chances of subsequent inflammation, as the old adhesions of the original perforation do; so that, although we may save life by operating, we cannot say yet, that we can cure the place we seek to cure. We remove it; but leave the adhesions of surgery in the place of adhesions of disease.

The diagnosis is made much easier in these cases if any tumor can be felt. By that we mean anything different in sensation to the touch, or percussion, from the rest of the abdomen; any thickening, or hardening, or obscure feel; above all any œdema of the parts, when the disease has gone so far, may make us feel quite positive, if it is on the right side, that we have to do with an inflammation about the cæcum, or appendix. Sometimes, however, the appendix perforates; abscess forms back in the pelvis under the edge of the ilium; nothing can be felt outside; and the little tumor is there, but so deep and overlaid with a mass of intestines filled with air, that it is impossible to appreciate it by the touch. It is in these cases that a careful examination by the rectum may give invaluable information. The finger

should be inserted as far as possible into the rectum; you make the patient strain down, and you gain a little; in a certain percentage of cases, where no tumor can be felt outside, it can be detected through the rectum, pressing down in the pelvis in the right iliac fossa; and once detected there, of course it confirms the suspected diagnosis of an abscess about the appendix, which we could not feel from the front. I think this precaution never should be neglected in examining any case of this supposed disease. Even if we feel a tumor outside, I should be disposed to make a thorough examination by the rectum; because we may find, to our surprise, that it has already gone so far that it begins to point, so to speak, in the rectum; and a dimple, with fluctuation, is not infrequently felt high up in the indurated mass in the rectal wall; and tapping may be done there, and the necessity for laparotomy avoided.

I would not have anything I say discourage in the slightest degree the importance and benefit to be derived from opening the abdomen to seek for the products of inflammation in and about the appendix; only, in feeble and tubercular subjects, you will have recurrent attacks about the region of the appendix, which in many cases will get well for the time being, without the use of the knife, by gentle measures; as fomentations and rest, and the free use of opium; and the patient go about, for a long while, without another attack.

COLOTOMY.

Colotomy is opening the colon to make an artificial anus; it is done for obstructive disease of the rectum. That obstructive disease is generally cancer. The rectum, as a rule, is not obstructed by cancer near the anus; it is obstructed higher up. The reason is this: if cancer, or any obstructive

tumor forms in the rectum, as high as you can feel with the finger, you find that the bowel is invaginated; conveying to the tactile sense very much the same impression that you feel when you examine the female and insert the finger at the orifice of the os uteri; around this is spread the hardened mass of cancer; that is, the bowel is pocketed through the stricture. You find nothing of this kind in the forms of obstruction which exist within an inch, or inch and a half, of the anus. There it is simply infiltration of the rectal wall; a mass of rough and ragged disease, through which you pass the finger into the cavity of the bowel above. Cancer in that region rarely becomes the cause of positive obstruction; whereas, higher up, the bowel is being forced down into the obstruction, where it is free to move about; and obstruction takes place by a species of chronic invagination. In these cases it is a fair question whether they will prefer to be relieved by the formation of an artificial anus; if so, the place should be as near the natural outlet as you can get, to save the action of the alimentary canal, for the purposes of complete digestion. It has been found that when the intestine was tapped very high up it interfered with the nutrition of the patient. A wound going through the first portion of the large intestine is disastrous to complete nutrition. The nearer to the outlet, the better the chance of perfect fæcal evacuations and good digestion.

You have two places, either in the loin and left side, or in the groin and left side. The advantage of the lumbar region is that you avoid the peritoneum. The advantage of the groin is, that, although you go through the peritoneum, you can get at the bowel more readily, and perhaps may make it more easy to wear a truss.

The operation in the groin is the easier; the operation in

the lumbar region is the harder. In either case, if you want to be perfectly safe in doing the operation, there is a little manœuvre which may be practised. Suppose it is done in the groin; you cut down and find the sigmoid flexure; pass long, curved needles in several directions and sew the bowel up thoroughly to the abdominal walls; leave it forty-eight hours; take off the dressings, and you find the wound still open; the intestine changed in appearance. This thin, glistening bowel is converted into granulations. You can slit it completely open without the possibility of extravasation. On the other hand, if you feel it is safe to do so, you may do the stitching up and securing, and make the incision at the moment of the operation; and this is done in many cases. It is said, that by the contraction of the wound, afterwards, the patient gets control over the solid evacuations. That, aided by a truss, may make the patient comfortable and prolong life. It is not a very dangerous operation.

ONYCHIA.

Onychia is a form of disease about the nails. In its simple form it is called run-round, or superficial whitlow; it occurs as a slight suppuration about the root of the nail, followed by the raising up of the epidermis; a yellow deposit of pus and abscess, which runs down along the side of the nail.

The remedy is free incision; washing out; and it gets well.

MALIGNANT ONYCHIA.

There is a form called malignant onychia, which is probably neglected simple onychia in the large majority of cases. We seldom see it in people well nourished. You find examples of it in poor, half-starved children, brought to the dispensaries and out-patient departments. These onychæ refuse

to heal. The nail is extracted; and the part treated as a fungus sore; and it may still refuse to heal, and may end in amputation.

CHANCRES ABOUT THE NAIL.

There is a class of ulcers about the nail which are syphilitic, and unfortunately they are most apt to assail members of our own profession. The number of doctors who get poisoned by a slight agnail, and chancre at the root of the nail, is large. Unfortunately, unless the physician is on his guard, he neglects it and thinks it is a simple whitlow; wonders that it does not heal. He poultices it. It is purely a specimen of hard chancre.

It refuses to heal under any treatment. Soon after that a gland is felt at the elbow and up the arm; and, later, syphilitic roseola appears on the body and the diagnosis is clear. I mention this, because I have seen quite a number, and heard of a great many more such cases, of a suspicious sore about the nail, in practising physicians. If it were my own case, I should promptly take mercury after such a sore appeared upon me. That speedily settles the diagnosis. The moment the patient is slightly mercurialized the sore softens and begins to heal.

DEEP FELON OR WHITLOW.

A deep felon or whitlow is a suppuration down under the theca and the periosteum, and usually coming on the last phalanx. It is intensely painful; does not swell much; but makes the pulp of the finger hard, and different in feeling from the tip of the other fingers. The pain is intolerable and persistent; destruction of the parts goes on with great rapidity unless relieved. Unless it is relieved the pus burrows up under the theca of the tendons and affects other joints of the finger; finally gets to the palm and forms palmar abscess;

extends without difficulty under the annular ligament, runs up under the superficial fascia of the forearm, and finally ends the process of suppuration at the elbow-joint. We see such cases where the arm and hand are subsequently crippled by the adhesions that have taken place.

The only treatment is early and thorough and deep incision; and it is a mistake to wait for it to ripen; the ripening is its destructive process. It never should be allowed to ripen; and a deep incision, made at once, will frequently abort the suppurative process, and lead to healing with granulation, in a very few days.

As a rule, pus is always to be sought for on the palmar side. On the dorsal side it is generally only a secondary consequence. On the palmar surface the pus is to be found. A good deal is said of the propriety of opening on the side of the finger. The danger on the side is damage to the nerve and vessels. The danger of damage to the nerve is somewhat serious.

When there is palmar abscess the patient is very sick indeed. The forearm is swollen and œdematous; constitutional symptoms are severe; chills; high fever and exhausting sweats. In these cases it sometimes becomes a question whether to seek for pus in the forearm. We suspect it is there. The symptoms are not relieved. The œdematous condition goes up the arm. The patient does not experience any relief from his pain. The safest place to reach it is in the centre of the wrist, above the annular ligament. Cut down until you reach the superficial fascia and come to the long flexor and palmaris tendons. Now take the dressing forceps and director and pick away between the tendons until you come to the space upon the interosseus fascia; and there you almost invariably

get a gush of pus. This is to be kept open and irrigated every day. Occasionally it becomes necessary to make additional openings higher up. This is good surgery. It saves the limb and life; but does not cure the member. The hand is not restored. Patients must expect, subsequently, some adhesion and stiffness of the tendons. If such adhesion and stiffness result, it occurs from the long continuance of the inflammation; from the fact that gluing together of the tendons has occurred, and contraction of the parts with a comparatively useless hand, in many cases; in no sense is this to be ascribed to anything the surgeon does; but wholly to the progress of the disease, before the surgeon was called in. You will find, often, the physician or surgeon blamed for consequences about the usefulness of the hand and arm, where really he saved what could be saved; but could not cure the part.

BUNION.

Bunion is usually upon the great-toe joint and is an enlarged bursa. Usually it is there for the purpose of protecting from friction against the side of the boot. When irritated and inflamed by pressure; when the joint is thrown out of its normal position by shoes which are too short; the end of the toe begins to be thrown in; the joint projects, and it becomes inflamed and tender. A sac is evident upon the surface of the bone; fluctuation can be felt. This sac is an inflamed bursa. Occasionally, by careful treatment, it may be made to subside without suppuration. This treatment should consist in the taking off of pressure; either by cutting the shoe; or by wearing a very large or thick corn plaster, which encircles the joint and allows it to ride free beneath the plaster. Applications may be used at night to

allay the inflammation in the part itself. Sometimes a poultice is very useful. You must not be carried away with the idea that we always apply a poultice to produce suppuration. It sometimes prevents suppuration; softens the skin; allays the heat; sweats and foments the part; and frequently produces absorption instead of suppuration. When suppuration exists and is unavoidable, it bursts and discharges through a minute opening. Then it is a long while in healing, because you have a little thickened sac or cyst, which continues to secrete, and it is most speedily cured by laying it open. You must investigate the sac and see whether it goes into the joint. If it does, it must be laid open freely and irrigated; and the part put on a splint. If it does not, the sac may be laid open, scraped out and forced to heal, just as any bursa would. The most important point in treating the early stages of bunion is to get the great toe on a line with the inner border of the foot, as it was intended to be by nature; and as you see it in all the old statues. The old sandal prevented the possibility of bunions; dragging the great toe out by a strap between the great toe and second toe. It is a good practice to put between the great toe and next toe a thick piece of piano felting, which can be inserted to keep the toe out, while the patient walks. The shoe must be made on a straight last; and with these means, a great many persons can get along, and prevent the formation of bunions.

XIX.

SURGICAL DISEASES OF THE BLOOD-VESSELS.

THE simplest form, of which we will speak first, is the ordinary

NÆVUS OR BIRTH-MARK,

that is, an enlargement of the capillary blood-vessels due to some unknown cause before birth, and generally developing and growing larger after birth. The face is the favorite seat for it; though occasionally it is found in the hairy scalp, or the back; it is usually about the eyelids, nose and lips. It usually appears on the infant as a small, flat, slightly-raised red patch, perhaps as large as the finger-nail; does not pulsate, but is spongy and erectile. If you compress it firmly with the thumb, the blood will be pressed out, and slowly return. When it happens to be near the mucous membrane, as of the eyelid, or nose, or lip, it increases because the tissue is loose, and it has a chance to grow and distend. In other locations, as the cartilage of the nose or forehead, it increases very slowly. This is the simplest form of enlarged vessels, being confined to the capillary circulation, which, of course, is dilated far beyond its normal size; but the disease apparently originates in it.

It is painless and innocent, except for the deformity which it causes. The ordinary nævus sometimes goes away of itself. If it is small, and in a place where it does not grow easily, after the excitement of the first dentition is over, it

frequently sinks away and disappears. If, on the other hand, it is where it has a chance to distend, or if it is a great deformity, an operation can be done to relieve it.

Very small ones can be cured by the application of simple caustics, which leave only a small puckered scar. Caustics like nitric acid may be used. A small one can be burnt out by the electric wire, with which it can be touched. This must be distinguished, in your minds, from the treatment of any varicose, or enlarged vessels, or aneurisms, by throwing a current of electricity through them, electrolysis. That acts by coagulating the blood and does not destroy the tissues of the sac. The electric cautery, or galvanic cautery, merely burns off the whole affair, and shrivels it up and makes an ordinary scar, just as nitric acid does. In places where the nævus is not conspicuous, as on the back or arm, it can be very well cured by vaccination. That sometimes may be worth thinking of in simple cases, where the nævus is small. In larger cases there are several ways of operating to get rid of them. The ligature may be used. This makes a bad scar always; can hardly fail to do so. The nævus may be surrounded by a thread and strangled in one or two directions, and allowed to slough out; and the wound heals by granulation. A neater way is to cut them out. If the tissues are loose so that you can cut around them in sound skin, you can make a very neat result. The whole thing can be dissected out and the skin brought together as you do in taking out a small, fatty tumor, or wen.

Injecting the nævus with styptics like perchloride of iron is frequently successful, but not free from danger, inasmuch as the thrombi which are formed in the vessels are sometimes taken up and carried on in the circulation; and instances have occurred in which the injection of nævi upon the scalp

of young infants has been fatal in a few moments. Of course, that is a very distressing event, and we have to reflect, after such an affair as that, that we could have done it by a safer way. The larger the vessels, the more the chance of absorption of clot, and some destructive consequence.

Small ones can be burnt out; larger ones can be strangled or excised. Some will go away of themselves.

The next form, which is more serious, is the venous form of

VARIX,

which is erectile tissue, composed of large veins; does not pulsate; and comes preferably about the mucous membranes. A common site is inside the mouth; inside the buccinator muscle, about or over the lips, in which case it frequently produces a great deformity. The lip enlarges and everts; and this large spongy mass of bluish color, not pulsating, hangs out upon the face. Inside the cheek they grow rapidly, and are rather difficult to extirpate. They somewhat resemble the venous condition we find in hæmorrhoids. They form occasionally in the vulva, and about the nymphæ. This form is distinguished by the fact that the tissue is frequently cavernous or erectile; and is composed of large blood cavities, and does not pulsate; but the blood can be pressed out of it like a sponge, and then it slowly fills again so as to be as large as before.

This can be cured best by the ligature. It would be especially dangerous to use the electric current. A very neat result can be got by passing curved needles on a handle, with threads, through and under, and about them, in various directions; securing the whole mass, and allowing it to slough out.

The other form, which is more intractable, though not

more dangerous, I think, is that composed of enlarged arteries, and now called

ARTERIAL VARIX.

This is made up of large, tortuous, intercommunicating arteries, originally formed by the small arteries, before they reach the veins. These dilate and form other anastomosing branches, until finally you have a considerable mass forming a tumor, which is pulsating to the touch, and which possesses some of the destructive power of an aneurism. If in the temporal region, it may absorb the temporal fascia, the muscle and the temporal bone, and finally lead to fatal meningitis. This form of varix is fed by numerous arteries around its margin, of considerable size; and the final supply of the whole current comes through the nearest main artery which feeds the parts with blood. In the temporal region the supply is from the external carotid.

Such growths as that, if they are let alone, sometimes do not become dangerous. If they are not extending they may be let alone. If, however, they are extending, and obviously absorbing the neighboring tissues, or if they cause pain, then it is better to try to cure them; and to cure them is difficult by operation because they possess a great vitality, due to the numerous arteries involved. In large cases, the best way, if it can be done, is to secure the main trunk first; for an aneurism of the temporal region to tie the external carotid. If this is tied with an antiseptic ligature and closed up, it will obstruct the vessel and check the flow through the carotid, without cutting through the trunk of the vessel, and without the danger of secondary hæmorrhage. Frequently this can be neatly done, so that the wound closes promptly; after a week, or so, the carotid is entirely cut off.

The result of this upon the arterial varix above will be to

starve it to a very considerable degree, but not cure it. It will begin to take its supply from anastomoses of the neighboring system, which supplies the head. But after the patient has passed through the first operation, then, while the arterial varix is very much reduced in size and has not had an opportunity to fill up again to any great degree, it may be safely attacked by tying the vessels round about, which feed it in other directions; and finally tying the mass; strangling it completely; and forcing it to slough out. In this way they are cured without danger.

On the whole, simple vascular growths may be destroyed with safety by the cautery; larger ones more safely with the ligature. Resulting scar is inevitable, except in the case where we can cut it out and bring the parts together.

The next enlargement of vessels that I will speak of, because it comes next in order, is

VARICOSITY OF THE VEINS.

Varicosity of the Veins of the Left Spermatic Region.—Varicocele, occurring almost always on the left side, is frequently a great mental trouble to the patient, and sometimes it is the seat of pain. When the varicocele becomes large and heavy, the veins dilate the deep layer round the spermatic cord; subsequently the superficial veins dilate, so that finally the two sets dilate; the deeper ones around the vas deferens and artery, and the superficial ones scattered on the scrotum going back on the perineum, and going up on the groin. The result of this heavy load of blood is to dilate the walls of the scrotum, and distend it very much, so that the whole of that side of the scrotum becomes larger than the right side, and eventually produces pain, by dragging on the spermatic nerve; in this case the pain is of a dull, aching

character, and extends up the cord, until it extends to the back and loins, along the course of the ureter, up to the kidney. This pain is annoying to the patient if he is working hard; and is always more troublesome in summer than in winter owing to relaxation.

Palliation may be afforded by a suspensory bandage. This has a tendency to prevent the disease from extending and increasing, and holds it in check. The unfortunate complication sometimes arises in which the patient is the victim of hernia on the same side with the varicocele. In that case the pressure of the truss on the external abdominal ring is liable to press on the recurrent veins, and lead to aggravation of the varicocele. The blood is pumped in by the arteries, the veins are already dilated, and are further obstructed by the pad of the truss. In such a case as this it may be necessary to operate to relieve the patient of the veins, on account of the pressure of the truss on the site of the hernia. The truss devised by Mr. John Wood is very useful in this class of cases. It is made in the form of a horse-shoe. The two arms rest on the pillars of the ring; the flat part of the pad presses over the internal abdominal ring. The result is that the exit of the vessels is left without compression, and it is very comfortable to wear in this class of cases; a little point worth remembering in treating a case of hernia and varicocele together.

Patients with varicocele are much more anxious to be operated on usually than the surgeon is to undertake it. The results of the operation are not always brilliant. Although it may relieve the veins which are tied, it is liable to have some effect on the nutrition of the testicle; but whether that effect is more than the effect of leaving a large varicocele alone and allowing the testicle to be dis-

tended with venous blood, I am considerably in doubt. It is fair to say that when a large varicocele is tied the testicle almost always shrinks, and in that way probably loses some of its function. All this should be explained to the patient; and if he wishes to take the chances, and is sure the varicocele is painful enough to warrant it, the operation may be done.

Morning and night showering of the part thoroughly with cold salt and water; taking of cold baths; great care to relieve any tendency to constipation; avoidance of wearing any tight bandages about the waist to compress the recurrent circulation, are useful. If the operation is done, it is usually done by ligaturing the veins, either by the open method of cutting down upon them and dressing the wound antiseptically, or the old method of operating subcutaneously.

This operation is followed by pain, swelling of the testicle and scrotum; requires the patient to be confined to bed some little time; leaves him afterwards for several months with a lump on that side of the cord, so that he is quite sure he is not cured; although you may feel that the larger that lump is the more certain is the cure.

There is a little danger in this operation. Phlebitis occasionally extends up to the abdominal cavity; and sometimes has been fatal. This should be taken into account before you undertake the operation. The danger is not great. It is something, however.

Varicose Veins. — The ordinary place for these is about the calf of the leg and around the tibia. The cause is usually largely hereditary; persons of a certain type who have a large venous system, large veins at any rate; and also position, standing and walking, constantly on the feet. The first thing which takes place is that the column of blood not

being thrown back promptly through these veins, they dilate. After they have dilated to a certain degree the muscular coat of the vein loses its tonicity, and thinning of the vein takes place. Then the dilatation presently causes a forcing open of the valves, one after another, so that, finally, in a bad case, if it is laid open, you may find all the valves, for quite a distance, laid back against the wall, and incapable of closing. The result of this is a struggle of nature to carry the blood back through other veins; hence, dilatation of other veins; rapid enlargement of all the anastomosing veins occurs, and eventually the diseased condition extends up to the groin, and involves sometimes the long saphenous vein in its entire length. In the short saphenous vein it extends up to the popliteal pouch. A pouch at the saphenous opening, and another marked venous pouch at the popliteal orifice, is very characteristic of the varicose vein. In addition to that, coagula form, numerous ones; and little hard lumps form throughout the vein at different points, chiefly near the valves, which form a partial obstruction to the current. Occasionally, also, calcareous salts, and deposits of what are called stones in the veins, phlebolites, are also found, of various sizes. That is the condition and that the history. Once begun, it is sure to progress, unless means are used for its relief. Moving about in walking compresses the veins where they penetrate the muscles, and adds to the obstruction in long-standing cases; also the giving out of more and more valves, and thus a greater weight of the column of blood. Soon after this has taken place œdema of the feet and ankles begins, and serum is forced out from these dilated vessels into the surrounding tissues. Finally, as a last stage, the venous dilatation extends even to the capillary system; and we find in such

patients the feet mottled with innumerable small blood-vessels, scattered about in groups where the capillaries have been distended. The feet and ankles in this condition are always swollen. The capillary veins are so dilated, and so many of them have been plugged by little coagula, that they do not go down and get relieved when the patients lie down at night; and a condition of chronic œdema of the feet results.

The best treatment is compression; and it is the most satisfactory. It may be done by a flannel bandage, if carefully applied; or by the elastic stocking; or in more marked and severe instances by the use of an India-rubber bandage, which will compress the veins very perfectly. The flannel bandage, in the mild cases, is the most comfortable that can be used. It must be put on every day and taken off every night. It does a good deal of good to bathe the legs frequently in cold water, and lie down and rest as often as the patient can. If the patient happens to be in easy circumstances he can get along perfectly well with a flannel bandage and cold baths and the rest he can take; and thereby prevent the disease from increasing very much. Not so with the patient who is forced to labor. In that class of patients the elastic stocking in invaluable; and frequently suffices without anything further being done.

In former times, surgeons seeing the varicose vein lying upon the skin with its dilated pouches, the thrombi and the useless valves, and its tortuous course, concluded that this was the whole disease, and that if that vein should be obliterated and destroyed, the disease could be cured; hence the older method of treatment was to destroy the vein by one of two methods. A favorite method was by caustic. This was done by a caustic of moderate strength, called the Vienna

paste, made of caustic potash and some other ingredients, fastened over the vein, tied on and forced to slowly burn its way. It was painful, but it was a very effectual cure. As it went on in this destructive process it set up periphlebitis, caused coagulation, destroyed skin, cellular tissue, and even made a deep scar, shrinking everything up, so that no vein could ever exist in that spot again. It was customary, where there was a long varicose vein like the long saphenous, to put half-a-dozen of these pledgets of Vienna paste up and down the limb; and allow this process to be done a number of times, until the vein was obliterated. This was quite safe. Thrombosis and diffused phlebitis rarely occurred, for the simple reason, I suppose, that it was gradual. Anything to which the body is subjected, if it is a gradual influence, nature accommodates itself to; so that it was a safe operation, although painful; and it accomplished what it set out to accomplish; but it did not cure, by any means, the disease. The other method which was used was the ligature, and this was more dangerous because its application was instantaneous. The current was cut off at once. Adhesive phlebitis and thrombosis was excited in the course of a few minutes or hours, and the travelling of clots and production of embolism was not a very rare consequence in this mode of operating. In addition to this, in old times, suppuration occasionally took place; and a diffused erysipelatous inflammation of the leg, already the seat of poor circulation, was apt to occur. However, in a very bad case, where they may be expected to do any good, either of these methods is justifiable; but as curative agents they are failures; and the reason is that although you destroy the vein, you have no control over the condition of the anastomosing veins which penetrate the

muscles, and connect the superficial with the deep veins; so that you merely convert a superficial varicosity into a deep one, if you destroy the superficial veins.

Philosophically speaking, the only treatment of varicose veins is compression and care. An operation may be done for a case where an ulcer is overlaid by a vein so that it will not heal until that vessel is destroyed, or something of that kind; but an attempt to cure a varicosity of a limb by these operative procedures is not successful, and is a matter of some risk.

PHLEBITIS,

or inflammation of the veins, is sometimes idiopathic; and sometimes the result of injury. It may come on of itself. If it comes on of itself it may be acute, or chronic.

It is supposed to be rather an inflammation around the vein than in the vein itself. The cellular tissue around the wall of the vein inflames, and the process continues through the vein; results in coagulation of the blood; plugging up of the current and continued building up of clots; so that sometimes an obstruction which begins down in the calf may extend up in the pelvis before the disease has run its entire course.

Certain diseases, apparently, bring on this condition, especially diseases of the erysipelatous type, and different forms of diffused cellulitis.

The appearance of phlebitis, when it occurs in the acute stage, is very marked. In the first place, pain comes on. Then it will be noticed that the limb becomes marbled with dark lines, which are the veins becoming obstructed. If these are pressed upon, it will be found that the current is flowing in them, but it returns with great slowness, and does not flow promptly, as in the healthy vein. The current

is slow; the vein becomes conspicuous and swollen and darker colored, so that it shows plainly under the skin. It is painful. The neighboring tissues are swollen. The cellular tissue is infiltrated and the limb becomes big and hard. Very soon it will be found that one of these veins is completely obliterated, and that there is no current in it, and that it can be distinguished very distinctly under the skin as a hard cord pursuing its course up the leg. It is impervious; filled with coagula; and these coagula are going to extend upward. Whether or not they will do any harm depends upon the cause of the disease. If the cause of the disease happens to be septic, the coagula appear to be imperfectly formed; soften readily; become themselves occasionally the seat of septic decay, and the factors, so to speak, in producing the different stages of pyæmia, and absorption of pus, as it used to be called, from the vessels, in distant parts of the system. But if the phlebitis happens to be caused by a blow or wound, which is doing well in a healthy individual, or comes on in a person of feeble circulation, who is old and feeble, and who has a slight coagulum form in the vein from the slowing of the current, then, in either of these cases, the course of the disease is not rapid; is not very acute, and it is not very dangerous. It is very annoying, very tedious, but does not usually result in septic infection, or the travelling of large embolic clots. Phlebitis as an accessory, as a condition of a septic state already existing, is one of the most dangerous signs that we can see; and we may almost despair of arresting its progress and its tendency to produce pyæmia, if we see it occurring in connection with a foul wound, or a bad state of the limb in which it happens to be; on the other hand, phlebitis of a more moderate and subacute kind is not essentially dangerous.

Treatment. — The treatment of the milder and chronic kind is the more successful, of course. The first requisite is entire rest in the horizontal position; and the next requisite is that, as regards any manipulation, the vein must be left entirely alone. Hot applications are frequently very grateful, and some of them of a good deal of influence in quieting down a moderate state of subacute periphlebitis. The limb should be in an easy and relaxed position; the patient confined to bed; and the parts heavily covered in large poultices. To these frequently may be added with benefit, laudanum, and outside of it India-rubber cloth, or oiled silk, so that the leg may be steadily steamed and fomented in the poultice. This gives comfort, and seems to assist in resolving the trouble. Patients who have had one of these troubles instantly recognize what is taking place. They are seized with a stabbing pain, and find a little knot developing, which is hard and painful. Then a minute red line, marking the course of the vein, may be seen. Patients who have this tendency, and are subject to many attacks, if they know how to treat it at once, frequently can, by a week's confinement at first, prevent months of confinement afterwards.

In the septic variety, accompanied as it always is by suppuration and cellulitis, deep and free incisions; removal of all causes of irritation; antiseptic irrigations and washes; sustaining the strength of the patient with strong tonics and alcoholic stimulants, etc., may do something to assist in arresting the diseased process.

VENOUS HÆMORRHAGES.

When a vein is wounded it bleeds largely, but only in expiration. When the patient draws the breath in, the blood

is drawn in towards the heart, and when the patient expires, blood flows with a great gush from the vein. This is the case in veins of ordinary size.

The most common cause of venous hæmorrhage, except from wounds, is the rupture of a varicose vein. This frequently occurs, and they bleed to a large extent; sometimes fatally, but not often. A venous hæmorrhage can be easily checked by pressure; and, if that is not sufficient, the vein can be exposed and tied exactly as an artery is tied. The old prejudice which used to exist against tying veins no longer exists; and whatever danger there may be in tying veins — the danger of setting up periphlebitis — is infinitely diminished by the fact that we use antiseptic ligatures, and dress them in an antiseptic way.

ATHEROMA.

The next subject we will speak of is that condition of the arteries which leads to the formation of aneurisms. It is called atheroma. It is a fatty degeneration of the inner coat of the vessel followed by ulcerations and the deposition of calcareous salts, brittleness and stretching of the wall of the vessels and the formation of a sac.

An aneurism means a sac, or bag, which contains blood. It is usually what is called true or false. If it is a true aneurism, it is a dilatation of all the walls of the artery. If it is a false aneurism, it is a dilatation only of a portion of these walls.

The mode of its formation is always consequent upon this atheromatous change in the arteries themselves. The arteries are very smooth elastic tubes. They twist and yield with every pulsation of the heart. They shrink and open. They are governed by a set of nerves which control the mus-

cular movements of the walls. They enlarge or diminish in consequence of the needs of the part to be supplied with blood. When the part or limb is in violent exercise and the person running rapidly, an additional blood-supply is sent. The arteries enlarge; they beat more rapidly and expand also; therefore it is essential to the life of a part that the artery should be compressible, elastic, distensible. When the condition, or change, which is called atheroma takes place, the artery becomes diminished as to its calibre and stiffened as to its walls; loses its elasticity; cannot carry any more blood at one time than at another time. The consequence is, in elderly people, when the atheromatous condition is well pronounced, that the blood-supply to the feet and distant parts is not only insufficient, but is incapable of being increased. Let such a part be exposed to cold and the blood cannot come. The result is, frequently, in the elderly, the gradual occurrence of senile mortification of the foot in consequence of a slight bruise, or a little lameness, or ingrowing nail; exposure for a few hours in riding; anything of that kind will gradually bring on stoppage of the circulation; starvation of the part and mortification; senile gangrene of the limb. That is one of the consequences of atheroma.

Another is that it not only stiffens the walls of the vessels, but leads to ulcerations, deposits of calcareous salts and thinning of their walls and formation of aneurisms. Without going into detail we can make plain in a few words how this takes place. Given a very smooth elastic tube which has got to carry a certain amount of blood, and is constantly in motion by the pumping of the blood through it, the first thing that takes place usually is the loss of brilliancy and smoothness of the innermost coat. Now the innermost coat of the artery is nourished mainly by imbibition of the blood which

runs through. One stage of the degeneration which results when the coat is not perfectly nourished is the formation of fat. Fat cells form. It loses its smoothness, becomes slightly roughened and softened. What takes place when in ordinary cases a current of blood that is being pumped through a smooth tube meets with an obstruction? What takes place when we cut an artery, or vein, and allow the blood to flow upon some surface? Immediate deposition of fibrin, and the blood separates into its clot and serum and fibrin. The result of this slight roughness inside of the vessels is that slow deposition of fibrin takes place; more obstruction ensues; the current of blood beats with irregularity upon the wall of the vessel, and the inner coat, being deprived more and more of its nutrition, finally gives way. The result is a slight ulceration. The result of the ulceration is a pocket of greater or less size in the wall of the vessel. In this pocket gradually become deposited the lime salts in the form of plates.

Given a point in the vessel where there happens to be a meeting and crossing of two or three currents, where the circulation is not so perfect, having to cross, as it would in a single tube, here let an atheromatous change take place with a little ulceration and you can see how readily that pocket will deepen, that ulceration will increase, and the coat of the artery will be stretched more and more, and finally we have a sac or pouch formed in which the blood must go round and round, and be delayed in its progress. This is the way the ordinary true aneurism is formed.

The moment the sac is formed, blood delayed in it and the circulation impeded, nature goes on to another process, which tends to cure it: and that is by the formation of large coagula in the sac, which shall resist the impulse of the blood; be buffers as it were against the danger, and lead almost to a

state of repair. The layers of fibrin which are deposited from the coagula on the inside of the sac become pressed down thinner and thinner, and those which lie next to the wall of the sac become very white, thin and firm ; the next less so, and the next less so ; so that you can see, in cutting into a fresh aneurism, a long series of concentric layers like the layers of a bark of a tree ; those nearest the sac white and hard, next a little darker, and the central ones more and more soft. Nature makes an aneurism by ulceration of the inner coat. She tries to cure this aneurism by the coagulation of the blood inside the sac itself. As these coagula form more and more, the current of blood must go more and more slowly and imperfectly through the sac. Finally the blood, instead of being forced through, trickles through, and the aneurism may be almost cured. This is nature's process. Now it seems to me that this process indicates precisely the course we should endeavor to pursue in curing an aneurism ; that is, to imitate nature as nearly as we can ; to slow the current, and encourage the deposition of coagula by gradual compression and by rest.

XX.

ANEURISMS (CONTINUED).

An aneurism is defined as a sac containing blood which communicates with an artery. We spoke of the mode of its formation in the last lecture. I said that coagulation of blood in the sac with successive layers of fibrin and clot was nature's method of trying to cure it. I should add, also, that nature throws out another safeguard on the outer side of the sac as the aneurism progresses. The sac of the true aneurism, owing to the ulceration of the inner coat of the artery and the giving way of the middle coat, finally consists wholly of the outer coat of the vessel. Its sac pulsates and stretches and throbs with every beat of the heart; and of course impinges on all the neighboring tissues, and gradually absorbs them. In doing this it cannot fail to light up an inflammation in the connective tissue round about; and, accordingly, we have a thickening of the sac on the outside produced by an inflammatory process in the connective tissue around it. Thus, then, we have nature trying to establish a series of buffers inside to check the flow of blood inside the sac; and, on the outside, by the inflammatory products of the connective tissue, resisting the pulsation within. In spite of all this, in a large aneurism, where it has got well under way, the disease goes on, and the force, like all hydraulic pressure, is irresistible and absorbs everything before it. Curiously enough, it is said that cartilage is a tissue

which resists the longest Bones yield before cartilages; soft tissue, of course, very rapidly.

The pressure on muscles and on veins and on nerves gives rise to great interference with the circulation of the part; and in concealed aneurisms in the deeper parts of the body, as in the trunk, usually gives rise to great pain, which is ascribed to rheumatism, to neuralgia, to various causes, for a long time before the true trouble becomes apparent. The bones are absorbed; the bodies of the vertebræ are eaten off; the sternum is eaten through. An aneurism presents itself at some unexpected point where previously there was nothing but bone and hard tissue, and then it goes on pulsating and thinning.

Its usual duration is said to be from two to four years. It generally terminates fatally, and usually by rupture. Occasionally it undergoes an inflammatory process and suppurates; and, rarely, in that way cures itself. In other words, by the time the sac bursts, so great a mass of protective lymph has been thrown up around it that the discharge is mostly of pus; shrinking takes place, and occasionally the aneurism is cured. More often, however, it bursts, with a fatal result.

The arch of the aorta seems the most subject to aneurism, and next to that the three or four larger vessels. The popliteal is a favorite place, next to that the femoral, then the carotid. The popliteal, apparently, is a favorite site for aneurism on account of the constant flexion and extension to which the vessel is subjected in the movement of the leg; and if a change begins, as it often does, by atheromatous deposits in the artery, there is the place where it is very likely to stretch and bend and be forced to give way, sooner than in other parts of the body. This is the true aneurism.

There are other varieties. In the first place, it is quite evident that we may at any time have a traumatic aneurism. This may be produced by a gun-shot wound by a ball. It is not necessary that the ball should pierce the artery to give rise to an aneurism, but run across, and wound and bruise its coats. A cut or stab will give rise to an aneurism. The blood is poured out into the cellular tissue. A species of connective-tissue sac is formed about this blood. It slowly forces its way into all the interspaces of the part, as the thigh, until finally the fascia lata itself may become the sac of the traumatic aneurism; the patient still surviving, on account of the slow daily and weekly loss of blood not affecting him so rapidly as a sudden gush from the wound; and in some of these cases in the false sac of a traumatic aneurism, several pints of coagula have been thrown out.

Then there is the dissecting aneurism, in which the dilatation and the leaking of the blood takes place between the coats of the vessel, and runs along its course until it finally makes a long oblong sac between the outer and middle coats of the artery, and dissects often for a good ways into the tissues.

Then there are other forms where an artery and vein happen to be wounded together, and arterial blood has been poured into the vein. This occurred frequently in former times when venesection from the vein at the bend of the elbow was so common, the vein overlying the artery on the inner side of the arm; frequently in puncturing the vein the artery was punctured. A varicose aneurism was formed between the two, and the current ran together. In these cases a curious pulsation is heard; a whirring sound; the limb is swollen and enfeebled. There is more or less pain. The collateral vessels all become very much enlarged; but this

process may go on for a good many years without leading to a fatal result.

What are the signs of aneurism?

Obviously a pulsating tumor; but this pulsation must be of a peculiar kind, and, as a rule, accompanied by a peculiar sound, to make it sure that it is an aneurism. The pulsation must be expansile; not merely beating up, but dilating. The sound is like the placental souffle, and synchronous with the pulsation of the heart. All tumors, however, which pulsate in this curious manner, and have a bruit, are not aneurisms, inasmuch as some varieties of soft erectile tumors and some of the softer forms of cancer pulsate and give a bruit in this same way; so that we must judge somewhat by the shape and size of the tumor; the history of the case; its effect on the circulation of the parts below, etc., to decide whether it is an aneurism or not. Every lump that is elevated on the artery and appears to give the sign of pulsation also, may not be an aneurism; because small solid tumors like adenoids, in which the glands, especially of the femoral triangle, overlying an artery, are lifted in pulsation, are frequently mistaken for aneurism. That is also true in the neck, where an enlarged lymphatic, particularly if located opposite the bifurcation of the external and internal carotid, is frequently thrown up with a marked pulsation, and mistaken for carotid aneurism. The other more reliable signs of aneurism are these: first, that compression of the main trunk of the vessel above the suspected point stops the pulsation in the aneurism (that, of course, would go without saying); second, that compression of the vessel below the suspected point always increases the pulsation in the sac of the aneurism; and, third, that the natural pulse in the vessels below the aneurism is enfeebled and sometimes lost.

Extensive pulsation in the site of a great vessel; a noise heard like the placental souffle; the ability to check the pulsation and the noise by compressing the vessel above; increase in the noise and pulsation by compressing the vessel below; and an enfeebled pulsation in the vessels supplying blood to the parts further down on the limb, are classical signs of aneurism. It is quite easy to find these in the popliteal, not difficult in the femoral, but in any portion of the abdominal or thoracic aorta these signs must mainly be wanting. They are out of sight, out of reach, perhaps may not affect particularly the circulation in the two legs below. The pulsation of the abdominal aorta itself, in the feeble, anæmic, emaciated person, may frequently be mistaken for aneurism when no aneurism whatever exists. You will find in the very sick and enfeebled, whose abdomen is retracted with emaciation, that by putting the hand just above the umbilicus in the central line and pressing moderately you get quite a forcible and steady pulsation synchronous with the beat of the heart; this is simply the overaction of anæmia. So that all the signs may fail in the case of an internal aneurism, except possibly you may hear the bruit, or judge of what is taking place by the long-continued pain which it produces.

How shall an aneurism be treated?

There are two modes. We might apply both measures to either form of aneurism in the leg or arm, but we could not apply operative measures to aneurism inside the thorax and abdomen. One class of measures are called constitutional, and the other operative. The constitutional measures are adapted only for the treatment of those aneurisms which are beyond the surgeon's reach, about the heart, in the thorax, in the abdomen.

The local or operative measures, of course, are adapted to all other classes of aneurisms, in the limbs and neck, where the vessels can be got at.

Valsalva, long ago, and Tufnel proposed certain methods for treating aneurism constitutionally, which are not without their effect; and indeed, as this is the only resource in these aneurisms inside the body, we are forced to adopt this treatment or none at all; and we may safely say, I think, to the patient, that if the Tufnel or Valsalva treatment does not cure, at any rate it relieves pain a good deal; prolongs life; renders existence comfortable; and postpones the day of the final rupture of the aneurism.

These constitutional measures consist of two things — first, trying to reduce the vigor and celerity of the current of blood in the sac by keeping the patient perfectly still in the horizontal position and allowing him to make no effort whatever; and also to give internally medicines which will check and slow the pulsations of the heart to a certain degree, such as digitalis, veratrum viride and strophanthus. The use of these medicines to slow the current, and absolute rest on the part of the patient, tend to quiet down the cardiac circulation; to diminish the number of throbs that have got to go through the aneurismal sac day and night; to reduce the distensile force of the blood; to favor the formation of clots, and check the growth of the aneurism. There is no doubt that a great deal may be effected in this way.

Anything that diminishes the throbbing and the force of the pulsation diminishes, in the same degree, pain, which is, as a rule, due to pressure on sensitive neighboring parts. A good deal is effected by selecting the diet of the patient, and giving food only of that kind which will be sufficient to sustain life without stimulating the arterial circulation. A

reduced diet, not starvation, but reduced; the avoidance of all stimulants of every kind; perfect rest in the horizontal position; remedies to reduce the action of the heart; and, in addition to this, Tufnel thinks he got a good deal of benefit from large doses of iodide of potash. The bromides have been used also with some effect. In this way an aneurism of the arch of the aorta, or the thoracic or abdominal aorta, or aneurism of the innominate, which are beyond reach, may be prolonged and quieted; and the patients may be kept going several years. If they are content to lead such a life, reclining in bed, pulsation will be brought to its lowest ebb, and occasionally cures have been effected. Occasionally spontaneous cures have occurred in aneurism without any treatment whatever.

Now as to the treatment of those aneurisms which are in the limbs. It is what is termed operative; but it is not of necessity the using of the knife. The number of modes of attacking these aneurisms that have been proposed is very great, and I will briefly run them over.

Incision, ligation, compression, acupressure, flexion, manipulation, galvano-puncture and the introduction of solid substances into the sac.

Antyllus, far back in Grecian times, attacked aneurisms boldly by opening the sac and seizing the vessels where they entered and emerged. This was done without ether and without antiseptics, and with almost none of the assistance that we have now. He saved a good many cases; and was a strong advocate of this method of treatment. The incision was made boldly through the skin. An assistant seized the artery above. The artery was tied at its entrance into the sac, and then the point of exit sought and the artery tied where it left the sac. The sac shrivelled up; slight suppu-

ration took place. If the ligatures ulcerated out without subsequent hæmorrhage, the patient recovered. Unfortunately, it was found that the same condition of the artery which made the sac often led to incomplete healing of the ligature. Secondary hæmorrhage took place in a good many cases.

The next mode of treatment was introduced by John Hunter, and consisted in tying the artery to control the aneurism at a distance from the sac, where it was healthy. He would tie, for a femoral or popliteal aneurism, high up in Scarpa's triangle, high up in the groin; and he would tie, for instance, for an aneurism of the radial, high towards the elbow; tying at a distance from the sac, between the sac and the heart. This was the usual method employed when the ligature was used to cure an aneurism — to tie at a distance from the sac, between the sac and the heart; because you are reasonably sure of having an elastic and healthy artery to hold the ligature; which is not the case within an inch, or half an inch of the sac itself. The immediate effect of tying, for instance, the femoral in Scarpa's triangle, for popliteal aneurism, is to arrest at once the whole circulation in the sac of the aneurism. Speedily great changes took place in the foot and limb below. Curiously enough, owing to some disturbance of the vaso-motor nerves probably, the temperature of the leg and foot rises after the ligature is applied. This is, however, of short duration, and after an hour or two the temperature of the leg and foot begins to fall, and steadily falls below the normal level, owing to the cutting off of the arterial supply of blood. You have a shrunken, pallid, cold foot and limb; severe pain as a rule. The circulation wholly ceases, for the time, on account of the cutting off of the main supply, which has gone through the femoral and the sac.

What possible protection is there on the part of nature to prevent this stoppage from being permanent, and the limb immediately mortifying and sloughing in consequence of the sudden and complete arrest of circulation? We now have take place a marvellous process called collateral circulation. We know the infinite anastomoses in arteries and veins. We know that pulsation extends through numerous branches which interlace, and wind about in every possible direction, in between the muscles and fascia, to supply the different parts of the limb. Some of these branches dilate, and thus is established the collateral circulation. If the femoral is tied at the apex of Scarpa's triangle, it is tied below where the great profunda trunk is given off. This circulates blood through the muscles of the upper part of the thigh. Gradually the smaller vessels dilate; and arteries, hardly appreciable before, become of considerable size. The limb is eventually supplied by a score of little vessels dilated, where it was before supplied by one principal stem. A similar change takes place when the carotid is tied. It takes place also when obstruction of the vessels takes place about the aorta, from the junction of the perforating artery from the sternum, and the superficial epigastric artery, going up in the sheath of the rectus, and forming a large loop of connection; this dilates so that those vessels become of large size, in obstructions in the abdomen.

Obviously success in curing an aneurism by ligature must consist in several things — first, that the current shall be completely cut off in the main artery, which supplies the sac; and sufficiently far away from the sac to prevent the chance of the ligature giving way prematurely on account of the atheromatous and rotten condition of the vessel near the sac itself.

Second, that it must be so tied that sufficient smaller vessels may be left to take up and establish the collateral circulation in time to save the limb below from dying from want of arterial blood. Those two problems have got to be carried out. Now a certain percentage of ligations of large vessels after Hunter's method are successful, and a very considerable percentage fail; not only to cure the aneurism, but to supply the limb. Of what use to cure the aneurism if subsequently you have to amputate the limb? You could have done that before. In a very considerable percentage after the Hunterian method, the leg and foot mortify; and this is the great drawback against its performance.

Other methods have been introduced which seek to obstruct the current in the artery, which I will only mention here, inasmuch as they are of the same class, and might as well be mentioned at the same time.

On account of the danger of suppuration and secondary hæmorrhage, Simpson introduced what is called acupressure, — to compress the vessel by steel needles. The needle was passed in, and passed under the vessel, and left in the sartorius muscle, for instance; and placed in such a way that it was held between the vessel and the superficial muscles. The artery was merely crossed and compressed by the needle for a limited space of time. Twenty-four to forty-eight hours was ample to secure permanent obstruction of the femoral in such cases. The needle was slipped out; the muscles fell back into place; but the artery was plugged.

This was a great advance over the old method. This was the first stage towards the better securing of vessels; but we, of course, have got by all that, since we have the antiseptic and organic ligature, made up of structures which either fail to excite suppuration, or are absorbed after the wound closes.

Catgut ligatures are absorbed. The silk which is prepared antiseptically probably remains; although it is possible it may be finally absorbed. Its fibre is much stronger than is that of the catgut, and resists much better. By one of these means we can now tie these large vessels and not expect to have them suppurate, or have any secondary hæmorrhage. That might encourage us to return to the method of Antyllus; and, in fact, it is now occasionally used with success.

With all due respect to these great men, it is evident that all these methods are unphilosophical, in that they do not follow the dictates of nature. Nature tells us to try to slow the current; to try to promote coagulation of blood; and to try to give time for the parts to harden; but not to cut off the blood instantly, for that she never does. Hence the method by digital compression has proved to be the most successful, inasmuch as it imitates more closely the processes of Nature herself. Formerly compression was applied rudely by means of a bag of shot, or an apparatus rigged with two or three screws and pads, so that you could push down one on one part, and another on another part of the artery; and these measures were often successful. Occasionally they failed; and they failed, I think, because the mistake was made of applying them too forcibly. It is not necessary to stop the current in curing an aneurism. It is only necessary to slow the current; take off the pressure and then apply it again; and frequently the aneurism can finally be permanently obstructed and stopped by the formation of successive layers of clots. The danger in the earlier times, in the use of compression, was that it was used so forcibly. The hand was never employed; but mechanical means wholly. These mechanical means were applied and kept on as long as it was thought the integrity of the parts would stand it; and the

process continued for several days. The result was frequently œdema, sloughing, abscess, cellulitis, such a condition of the limb that afterwards no further operation could be attempted on the vessel or the part, provided this first method of treatment failed. Hence, if you are going to ligature an artery for an aneurism, do not touch it by any other means first; but if you are going to try compression, these measures may be used; but you must not expect a favorable opportunity to ligature the vessel afterwards, because the parts will almost always be so changed by œdema that the ligature will fail, and secondary hæmorrhage occur, and antiseptic methods prove an entire failure. Either ligate or compress.

If we compress, it is best done by the hands of numerous assistants, and done with the fingers; holding them so as to almost entirely obstruct the current in the artery for a few minutes at a time. The human hands will not keep up pressure on the artery long. They have to be relieved as often as once in ten to fifteen minutes. It is not desirable that absolute stopping of the current should occur for any length of time. It may be held still a little while, and allowed to filter, the effect being carefully watched in the diminished pulsation in the sac; in its thickening; and the temperature of the parts being watched to see if any inflammatory changes are taking place. It is the most philosophical and best way of treating aneurism when it can be done. Obviously it cannot be used as well for the carotid as for the femoral or axillary. In pressing over the carotid we have to press down upon the pneumogastric nerve. We generally give rise soon to great pain and distress and symptoms of irritability of the whole sympathetic system; consequently consecutive and long-continued pressure on the carotid is not generally well borne.

In such a place we have only one other resort, and that is the ligature.

We have by no means finished all these methods that have been tried; and I will not dwell long on them; but will allude to them, in order that we may understand what was done, and why.

There is the method by partial compression. In popliteal aneurism the leg was tied up in extreme flexion. It pains terribly. The patient cannot stand it long. It requires large doses of morphia. The leg has to be tied up and let down. Slow obstruction of the current in the popliteal vessel; plugging of the vessel and stopping of pulsation in the aneurism, sometimes in four or five hours, very often in twelve hours. This method in the popliteal region, and at the bend of the elbow, is a very effectual method; and if it is not persisted in too harshly, it is frequently successful. You must be patient. It is a mode of treatment that has not infrequently been successful, and has occasionally been disastrous by being persisted in too long; by making the aneurism slough and leading to secondary hæmorrhage. You cannot appreciate the amount of pain that the patient undergoes when the leg has been tied up in the flexed position for a short time. The pain is intolerable. The leg is occasionally relaxed a little and then brought up again. Large quantities of opium are given. You do not have this pain with gentle manipulation of the fingers on the groin, not to such an extent; though in almost all the immediately compressing methods the patient has to be supported through the treatment by the internal use of opium, to quiet the nervous system to a moderate degree.

Manipulation. — That would seem to be a very rash method; and yet it was formerly applied; consisting in taking the sac of a large aneurism and kneading it with the

fingers so as to force the blood to coagulate. The result was breaking up of clots in the part, travelling of emboli, and usually disastrous results.

Galvano-puncture is pretty much like the injection of astringents into the sac. By that is meant the throwing of the galvanic current through the sac and causing the blood to coagulate by the process of electrolysis. The blood coagulates around the two poles of the galvanic current carried through. In small aneurisms, if the parts around can be secured from the travelling of clots, no doubt it would succeed. In larger aneurisms it is dangerous.

Ergotin has been given subcutaneously to contract the walls of the vessels. Bear in mind that here you are dealing with a two-edged sword. You are not only contracting the walls of the vessel itself, but diminishing the circulation in the limb beneath, and spontaneous gangrene has followed the use of ergot, without any aneurism at all. Ergotism from eating spurred rye has been followed by epidemics of gangrene in various parts of Europe. Ergotine will contract the coats of the vessels in the parts where you do not want them contracted, as much as in the parts about the sac, where you do.

The Introduction of Substances into the Sac. — That is a very curious phenomenon. It is applicable principally to the arteries of the thorax and the abdomen and the innominate, for instance, parts usually treated by what are called constitutional measures. This consists in taking a very fine roll of silver or nickel-plated wire, puncturing the sac, and passing in, perhaps, yards of fine wire. The result is coagulation of fibrin around these little fibres; immense increase in coagulability; occlusion of the aneurism; in a few cases cure; in many cases suppuration and death. It may be

tried as a last, and I would say almost desperate, resort in the case of innominate or thoracic aneurism, where the sac can be got at; and where the methods of rest, sedatives, starvation and drugs have failed; where the sac has increased, and the patient is going to die, it is quite justifiable to try this method, provided the patient understands it, and wishes to have it done. A few cases have succeeded, but not a great many.

We are reduced then I think, after all, in the operative treatment of aneurisms, to only two methods. One is to tie the vessel; the other is to compress it. It may be done in a great variety of ways, and is frequently curative. The danger of too sudden ligation, or of sudden compression, is that there is not time enough to establish the collateral circulation, and that the parts below will die, and mortification take place. This may not extend up very far. Sometimes the patient loses a toe, or several toes; sometimes the process stops at the instep; and sometimes involves the whole leg; and where such a result does occur we might just as well have amputated the leg before and saved all this trouble, as amputate it afterwards for spontaneous gangrene. A distinguished physician in London, a few years ago, preferred amputation of the thigh to the tiresome and unsuccessful treatment of a large popliteal aneurism; and he promptly recovered from the operation. There is an open question, in case of a large aneurism, where there is a good deal of doubt whether you can cure it without gangrene, in regard to the proper method of procedure. Undoubtedly the majority would say they preferred any chance of ligature or compression, rather than the chance of losing a limb.

Venous aneurisms, or, as they are sometimes called, varicose aneurisms, which consist in a communication between

the artery and vein, in consequence of a wound which has failed to kill the patient by bleeding; which has let the arterial blood run out into the vein; are frequently of long duration; not always fatal; do not always increase fast; and do not always call for surgical interference. Unfortunately they often happen in inaccessible parts of the body; for instance, stabs in the groin and wounding of the iliac, so that the iliac arterial current communicates with the iliac vein. Such a case gives rise to an enormous buzzing tumor inside the abdomen, which is heard with a whirring, rasping sound, pretty much like the saw, or a planing machine. This gives rise to pain and œdema of the leg; retraction in order to favor it; and to incapacity; but not necessarily, or rapidly, to destruction of life. If these cases can be reached early, they may be cured, frequently, by compression; and that is the most judicious form of treatment to apply. If they are small and very accessible, they may be laid open, and the artery and vein thoroughly tied.

XXI.

DISEASES OF THE BONES.

THESE are just the same as the diseases of the soft parts, only they have different names. What is called ulceration in the soft tissues is called caries in the bone; and what is called mortification in the soft tissues is called necrosis in the bone. The names, however, need not confuse us; but the processes which take place in bone as distinguished from the same processes in the soft tissues are very different on account of the difference of the tissue. The bone is immensely hard. All processes which take place in it are proportionately slow; and the process of ulceration, or the process of suppuration, or inflammation in the bone itself, is a matter of weeks or months; whereas the same process would run its course, in the soft parts, in a few days. Singularly enough, bones, which are quite free from sensitiveness, become excessively painful when inflamed; and this is due, probably, to the fact that their interior is subjected to an immense hydraulic pressure on account of the hardness of the bony structures, where inflammatory processes and exudations are taking place; just as the pain of felon or deep whitlow, which is intense as compared with the pain of a superficial abscess in a lymphatic gland; just as we know that that must be due to the fact that pus is shut down on the bone under the periosteum; so, in the bone itself, inflammatory processes are very painful, as well as very slow.

The first class of affections of the bones which we naturally would take up would be those which affect the periosteum or membrane which nourishes the bone upon the outside. The periosteum is, in its healthy state, a thin and nearly transparent membrane, made up of a delicate web of connective tissue containing vessels, clinging closely to the bone, fitting it snugly in every direction, having to be dissected up to distinguish it from the bone and affording the superficial bone a large part of its nourishment. The Haversian canals and the inner periosteum also nourish the inside of the bone. The simplest and most common affection of the periosteum is called

SIMPLE ACUTE PERIOSTITIS.

It usually comes on in consequence of a blow, or frequently by great exposure to cold. It has frequently arisen from the patient's plunging into freezing water, or standing for a good while in snow, and then walking about briskly and restoring the circulation too rapidly, or approaching a fire, something of that kind. It often occurs over the tibia. I will take that as a site of the disease easy to demonstrate and talk about.

What are the signs of simple acute periostitis? Always swelling, always a tumor, but small, defined, oval, firm, painful. This is due to the pouring out of serum and the white cells of the blood between the periosteum and the bone. Nothing can resist this hydraulic pressure. The bone does not give way, but the membrane over it does, and it rises out in the form of a sac. This sac raises the fascia and muscle over it and the skin, so that we feel the tumor on the surface, which is due to effusion of serum. It does not fluctuate. It is too tight and hard to fluctuate. There is no

discoloration of the skin. A painful, non-pulsating and non-fluctuating tumor over the hard bone; that is the peculiarity of acute periostitis.

It arises also from other diseases. It arises very frequently from syphilis. Then it is of a much more subacute or chronic character. The pain is aching and dull. The formation of the tumor is slow. It never reaches the suppurative stage. It forms an outgrowth upon the bone called a node, beneath the periosteal layer.

The treatment of acute simple periostitis is easy and quite sure to effect a cure if it is attended to promptly. The limb must be kept strictly still in the horizontal position; warm fomentations applied over it are often sufficient. If that is not sufficient, a cure may be hastened by a blister, or the strong ethereal tincture of iodine, or compound tincture of iodine, applied. In the mild case, often the result of rest and warmth and subsequent blistering is to cause gradually an absorption of the effused fluid; the periosteum settles down upon the bone and the disease is cured. If, however, the disease is seen at a later stage and has gone too far to be relieved by this simple method of treatment, then the best treatment is an incision, which should be made down to the bone until we are sure that the knife scrapes on the bone itself. That is curative at once. Inflammation subsides; the pain goes away; bloody serum and thickened flakes come out through the opening in the periosteum. Possibly suppuration takes place, but not always. If the part is stuffed with antiseptic gauze, probably it will not suppurate. The pain is relieved at once, and the patient gets well. That is simple, acute, circumscribed periostitis.

There is another form called diffused periostitis, which corresponds to diffused cellulitis in the soft tissues, and is

distinguished from abscess; and this diffused periostitis is one of the most fatal and rapid complaints that can occur. It either destroys the patient's limb and leads to amputation after spontaneous fracture of the bone, or, more frequently, it leads in feeble persons to death. Diffused suppurative periostitis is exactly like diffused suppurative cellulitis. There is no boundary wall of lymph; no limit of the disease. It strips the periosteum from the bone and forms an immense sac of pus with marked constitutional symptoms.

On account of the very severe constitutional symptoms it produces, the name of typhoid of bone has been given to it. It occurs almost always in children, affects especially the lower part of the femur and upper part of the tibia, and produces intense constitutional symptoms resembling typhoid fever. The child has high temperature and sometimes a slight cutaneous eruption like typhus; becomes rapidly and intensely sick; and swelling and œdema begin about the lower part of the femur, usually above the joint and deep in under the fascia lata, so that it does not make much external showing at any particular point; general œdema, with great pain, and very severe constitutional symptoms.

The progress of the disease, if let alone, is that suppuration forms under the periosteum on the shaft of the femur without any boundary being set up by the pouring out of lymph; strips up the periosteum; bursts through the periosteum; makes a large sac of pus held by the fascia lata; and in consequence of its denuding the shaft of the femur of periosteum, the bone, lying in this mass of pus so long, rapidly becomes carious. Sometimes the disease goes through the bone and affects the medullary cavity, if it goes on long enough. It is very difficult, almost impossible for this abscess to burst; the fascia lata making a secure bag for it.

It retains the pus, and you are conscious of a large fluctuating sac. The child sinks into a state of great exhaustion. If the disease goes still further unrelieved, the medulla of the femur having been invaded, the shaft becomes carious and extremely brittle, and in some slight movement breaks; and you have spontaneous fracture of the femur, shown by great pain and by the drawing up of the two ends of the bone. This is an extreme condition and it is usually followed by death. Occasionally, it is said, the disease appears on the upper part of the femur. It does not, as a rule, affect the joints; but the shaft under the periosteum.

This disease is unfortunately often overlooked in its earlier stages when something might be done to control it. It is mistaken for typhoid fever, or rheumatism; and it is not until extensive destruction has taken place that the presence of a fluctuating sac is detected. Then if it is laid open, and the surgeon passes in his finger, he finds the shaft of the femur lying smooth as a stick, without any covering, running through this sac of pus. Amputation in that case is frequently the only means of saving life; the disease of the femur having gone so far that it is incapable of repair. If the disease can be recognized, and is recognized early, no doubt much can be done to relieve it.

The commencement of the disease is down on the bone just as felon is on the finger, but the depth from the surface is vastly greater than in the hand.

The true treatment is early and deep incision. This must be made, however, with great caution. The skin and cellular tissue should be cut through; then the fascia lata nicked and pricked, and slit up on a director, and the finger passed in, and perhaps the director, and moved about until pus is reached. When found, free incision should be made, and

the cavity washed out. It is better, probably, to make two incisions on opposite sides, put through a drainage-tube, and irrigate constantly through the tube. If this can be done at a very early stage, the femur may be saved, otherwise not.

Almost all the cases I have seen have been hospital cases; and those I have seen in private houses have been just as far advanced as when they are brought to the hospital. All the cases I have seen have been in the advanced stage, where there was a large sac of pus, the femur already denuded, and destruction gone on beyond the chance of doing any good. I have once or twice seen spontaneous fracture, several times amputation, and several times death. The worst amputation is that which has to be done in the feeble person above the middle of the femur; and it is very liable to be fatal, on account of the severity of the operation, the location of it, and the weakness of the patient. Sometimes there is no other resort to try.

This disease is not very much insisted on in text-books, but, as it is the cause of loss of limb and life, I have dwelt a little more upon it; and you will find in the poorer population of all cities, among feeble children, these conditions come on not very rarely.

Exposure to cold and blows, going in bathing in improper seasons of the year, being wet and going about in wet clothing, blows about the tibia and femur in the feeble child ill-nourished, will bring on this condition, or some other form of suppuration of bone. Sometimes it brings on abscess in the bone itself, of which we will speak presently.

CARIES

Is an ulceration of the bone; a disintegration and breaking down; washing out of lime salts; changing of cancellous

tissue into either a tubercular cheesy mass, or fat; and the formation of a soft vascular mass, which rapidly loses it firmness, and remains as a soft substance inside the cancellous tissue of the bone. As you might suppose from that description caries almost always occurs near the epiphyses, rarely in the shafts. It is about the joints that you see almost all the cases of caries. Caries is not confined to any age, but it is more frequent in the young; and necrosis, I think, is more common in the adult than in the child.

There seems to be no reparative effort in caries. It is an ulcerative process, and goes on very slowly and insidiously; not very painful; no very acute symptoms; and destroys large surfaces on the inside of the bone, and finally gives rise to an abscess, in many cases with a sinus leading down into the cavity. Through this, after a long while, the patient may succeed in throwing out the pus and all the broken-down cancellous tissue; and in some cases the disease will heal up spontaneously under constitutional treatment and without surgical interference; but, if it is recognized, it unquestionably does better with surgical interference; and in some cases, if it can be attacked early, it seems as if it could be almost aborted; that is, you have the symptoms, for instance, of a slight amount of swelling and œdema; a tender spot on the foot; lameness in walking; perhaps a little hectic at night; occasionally occurrence of sweats; if the symptoms persist a good while and the surgeon makes a prompt incision down upon the bone, he finds usually the periosteum thickened and somewhat separated from the bone. He finds, to his surprise, when he presses upon the bone that it is a shell; it lets a blunt instrument push into it; break through this little outer shell and you find a carious cavity, which was originally the cancellous tissue of the bone. It

has all been thinned out and absorbed, so that it is semi-fluid; and there is nothing but a shell of bone surrounded by periosteum. In this condition of things, if the cavity is carefully curetted and drained, and packed and washed out, frequently a good result ensues.

NECROSIS.

Caries is somewhat different from necrosis in this respect, that you may scoop out all the carious cavity down to a point where it seems that nothing more can be scooped out without violence, and may have that promptly followed by repair. Such is not the case with necrosis. If you attack necrosis and attempt to cut it away, before nature has separated it and marked the line of demarcation between living and dead bone, you do not succeed in establishing repair; but the necrotic process goes on, until the limit is set by nature, and the piece can be removed. This loose piece is sometimes called a sequestrum; and it is only after it is thoroughly detached that it can be removed with any great advantage. It may be hastened to a certain degree by cutting through the shell of bone that surrounds it, and giving it free exit; but it is hardly useful to attempt to tear it away before it has become loosened itself, because you cannot end the disease until nature has stopped the necrosing process.

Necrosis is like gangrene or mortification of the soft parts. Some portion of the vessels of the bone become obstructed; the Haversian canals become shut up with inflammatory exudation or coagula; the nutrition is cut off from quite a piece of bone, and it dies; and then nature makes the effort to separate it from the living tissue by an active process of exudation, inflammation and suppuration around it. This gives rise to abscess. Then the abscess drills a hole through

the bone; then comes up to the surface under the fascia, and finally makes a small outlet, and leaves one of those little red pouting sinuses. You pass the probe, and come down upon a little hole, of which you are conscious, in the bone, about large enough to admit a shot; and then you strike inside a bare portion, which may or may not be loose according to the length of time the disease has existed. Meanwhile, nature surrounds this bad piece with a strong circle of vessels, and active inflammatory processes, which finally slough it off and let it lie loose in the cavity. Now comes in a very extraordinary process of nature to prevent fracture of the limb while this destruction takes place. Suppose the necrosis takes place in the tibia. While the dead bone is being separated and got ready to be thrown off, new bone is thrown out all around to strengthen the diseased shaft; and an involucrum, or shell, is formed around the diseased piece; and the bone enlarges, and is very much broader than the tibia of the other side. In the midst of this enlargement you find the sinus which leads down directly through the bone to the sequestrum. The formation of new bone is a very important provision on the part of nature to prevent fracture of the limb while separation of a dead piece of the shaft takes place. But at the same time this change defeats, so to speak, the other object of nature, which is to cast off the dead piece, because it encloses it firmer and firmer in the shell. The result is that a sequestrum, *per se*, is never discharged from the living tissues. It is held in sometimes for years; and it rattles about, so to speak, inside the tibia in this cavity, surrounded by new bone: never healing; always keeping up a slight discharge; but never having an opportunity to escape.

There is not much pain in this process. It is a slow pro-

cess. I have seen sequestra in the tibiæ of patients who have gone about, and the duration of the disease reach forty years without any operation; without much impairment of health, and without a great deal of pain. But the disease does not get well until the surgeon interferes. So then, when we have found this sinus, the true practice is to cut down and chisel away and trephine away a large portion of this shell of new bone, to open up the cavity in which the sequestrum lies. If it is loose we take it out; and if not, we wait for it. If we take it out, it promptly heals, and becomes a strong serviceable limb.

These are the marked differences between caries and necrosis. Caries is essentially destructive throughout. It is an ulceration. It occurs frequently in youth; almost always about the epiphysis. It is slow, insidious, but it does not get well, as a rule, without operative interference; and if the cavities are scraped out, it usually gets well. Necrosis, on the other hand, is a disease of strong adults, frequently. The diseased piece can never escape. It is incurable except by operation; and the operation usually is curative. Sometimes, however, it unfortunately happens that the bone is so thoroughly diseased that the same process is repeated in different portions of the shaft over and over again; and occasionally you see the tibia so riddled with sinuses, and so deformed by the growth of new bone, that it is practically useless; and in such a case amputation is the best treatment for the patient.

ABSCESS OF BONE.

There is a form of suppuration in the bone which is called abscess of bone. The peculiarity of this seems to be that it is essentially a pus formation, without caries or necrosis, taking place somewhere in the medullary tissue of the bone.

It generally occurs somewhere near the joints; but may be in the shafts of the long bones. Unlike the other affections of which we have spoken, it is intensely painful. The agony is great and lasting. The patient loses sleep, emaciates, has unbearable pain all the time, and there is no apparent cause for it; he will point out the location of the pain, but you cannot see any change on the outside. You may, perhaps, by taking the finger and rapping about on the bone, come upon a point where he winces every time, and says it is exquisitely painful; and you may find a slight degree of œdema. There is not much swelling, but constant acute pain, which must be distinguished from neuralgic pains, which latter may last months or years. This pain is due to formation of a small amount of pus, rarely more than a drachm, in the bone; shut in; trying to bore its way out. It is, I suppose, comparable to the pain of felon in the hand. If this disease is recognized, a cure is quite easy and certain. Cut down upon the bone and trephine the shaft and open the medullary cavity and give exit to the pus, if it is found. If it is found, I say, because sometimes after trephining you are disappointed that you do not strike directly upon pus, and have been deceived perhaps to the extent of one-half to one inch in the location of the pain. It is not exact, and you have not hit the exact spot. In this case by taking a gimlet, or something of that kind, and boring up and down in the medullary cavity, you almost invariably strike the pus; and you are surprised to see how little there is, and you are also surprised to see how absolute the relief is; and how promptly this cavity will granulate and heal up. These, if they can be recognized and treated, are an extremely satisfactory class of cases. Unfortunately, like the cases of acute diffuse periostitis, they frequently

are not diagnosticated until they have produced destructive effects in the bone itself.

OSTEOMYELITIS.

There is a disease of the marrow of the bone which is like a diffused periostitis; that is to say, it is a diffused inflammation of the cavity of the bone and that membrane, which lines the inside of the bone, sometimes called an endosteum. It is not a distinct membrane, but made up of cellular tissues and fat cells, whose vessels nourish the inside of the bone. The disease, as you might suppose, shut away inside the cavity of the bone, is usually the result of traumatic causes; either a compound fracture, or an amputation. Those are usually the causes of this disease, which is named osteomyelitis, or an inflammation of the marrow of the bone. After amputations it is not infrequent. After compound fractures it occurs occasionally, and is frequently fatal. After amputations it is not fatal, as a rule. But after compound fractures it frequently is. The reason of that is this, that after the amputation you have the end of the bone exposed; the bone sawed off; the medullary cavity open; and if the disease comes on there and osteomyelitis takes place in the stump, the stump does not close, never heals, keeps up a pouting, discharging sinus communicating with the medullary cavity. This is a safe exit, so to speak, for the suppuration which is taking place; and prevents, probably, the absorption of this material higher up into the system; so that, as a rule, the person with osteomyelitis after an amputation recovers. But if you have a compound fracture, and the bone is broken into the medulla, the cavity is pretty much covered over. If this acute inflammatory process begins it has no exit, and travels up the shaft, and

rapidly gives rise to intense symptoms, and frequently terminates in septic infection, in septicæmia; and occasionally in that process called embolism of fat; and in the carrying up of other septic materials into the system; so that osteomyelitis after compound fracture is generally accompanied with intense constitutional symptoms, and terminates often in a fatal septicæmia.

In a case of osteomyelitis after an amputation, the stump does not heal. The patient goes about without much pain. Exploration of the end of the bone shows that a piece of the central portion has separated; that a cast, so to speak, of the inside of the bone has formed; and, after a while, cutting down upon it and scraping back the tissues, you can seize this cast of the interior of the bone and draw it out; this is a true sequestrum of the inside of the bone. If it can be extracted entire, this is speedily followed by healing and cure.

SCLEROSIS.

In consequence of a very slow infiltration into the Haversian canals and connecting cavities of the bone which nourish it, the bone salts get deposited in excess, sometimes, and the bone thickens and hardens without any acute suppurative process; grows thicker and harder and heavier; and what was originally perhaps a shaft of bone becomes increased to twice the usual thickness; and this process is called sclerosis, or hardening. Such a bone becomes very heavy and large. The disease is slow and it is not productive of very acute symptoms, except dull pains.

It is sometimes the result of poisons; occasionally the result of syphilis; and it is apparently, as far as I can see, irremediable, and sometimes leads to amputation. If it is directly the result of syphilis, it is more likely to show

itself upon the surface of the shaft, in the form of hard, bony nodes which grow beneath the periosteum. These can be benefited often by blistering the skin; and frequently by the taking of large quantities of specific medicines, which affect the system in the tertiary stages of syphilis; but in the other process, in which the bone grows hard slowly without syphilitic infection, the bone sometimes remains in that condition for years, without producing any great trouble except its weight and dull pain.

ABSORPTION — POROSIS.

On the other hand, there is occasionally a condition of bones in which they absorb and grow thinner and thinner; absorption of the shell takes place; and the bone becomes exceedingly brittle and weak. Those are the rare cases in which what is called spontaneous fracture takes place, without the history of any injury, or any force that was sufficient to break the bone. Instances have occurred in which the patient, in this feeble condition of bone, is lifting only a book from the table, and drops it, and finds that the humerus is broken. This is absorption, porosis.

Unfortunately we do not know its cause; and do not know how to relieve it.

It must put us on our guard always with regard to prognosis in all troubles about the bones, and especially in the subsequent use and strength of fractured bones, because, occasionally, in spite of the best care, atrophy, or wasting, or porosis of the bones does occur after the injury; and the fracture, although it joins, does not become strong. The arm shrinks and dwindles and breaks, or becomes practically useless. It should be distinctly understood that this process is beyond our control; that we can in nowise be held

responsible for it. We should be on our guard as to giving too favorable a prognosis.

ATROPHY.

Atrophy sometimes takes place, by which the bone wastes away until, in some cases, the humerus has become shortened an inch or two in consequence of this process, and the elbow has approached the shoulder. A very small bone is felt between, which is feeble and brittle, and the bone atrophies in its entire length with shrinking. This is quite rare, but occasionally takes place.

HYPERTROPHY.

The opposite change, or hypertrophy, or bony outgrowths, which are distinct from sclerosis, occasionally occur and make great deformities; sometimes come on the collar bone making large bunches. We suspect that they are syphilitic, but they do not always yield to syphilitic remedies. They form on the face, on the superior maxillary bones, and give rise to that sort of face sometimes called leontiasis; here bony outgrowths take place, push the nose back, and growing out beyond the nose, push the eyes up out of the orbit.

These are true exostoses or bony outgrowths from the bone itself; and when operated on and cut away are found to consist of pure bone.

The only treatment is to cut and trephine and chisel them away, in the hope that when the flesh has healed over it the growth will not recur. Occasionally, these growths form in a curious way on the forehead, in the front wall of the frontal sinus; and the inner part of the growth lies in the inner part of the frontal sinus. After cutting through the skin and stretching it back, we find we can lift the bone out of

its bed in the frontal sinus, and a cure will then speedily ensue. But this seems to be a somewhat different sort of growth from those which grow with large bases from the superior maxillary bones.

In certain classes of the chronic insane, in chronic dementia, there seems to be a change in the bones with regard to the phosphates, and the bones become weak. It is probably true that a good many cases of fractures of the ribs, which occur among the insane in asylums, are due to very slight force, like spontaneous fractures anywhere; and while they may be ascribed to brutality or carelessness on the part of attendants, I am inclined to think this is often not the case; and that they are in that condition that they will break almost spontaneously on account of the feeble state of the system. This occurs occasionally among those in perfect mental health. I have once or twice seen myself fracture of the rib caused by coughing in an otherwise reasonably healthy individual; in a person somewhat obese and of about sixty years of age. In this case, after a violent attack of bronchitis and repeated coughing, the rib gave way after an expulsive effort. This should prove to us that in so thin and slight a bone as the rib it may become porous, and give way without any positive severe violence.

OSTEOMALACIA.

A very curious condition is osteomalacia, in which spontaneous fracture takes place over and over again. In these cases the patients frequently live to grow up, and the limbs are deformed with innumerable fractures. In such cases among children the slipping down off the chair on to the floor will cause the leg to give way; and these breaks, fortunately for the individual, heal promptly, and then give

way in another place the next time. This is a little different from the condition known as rickets or rachitis; because that is a condition of the bones in which they bend rather than break. In true rickets, the proportion of earthy salts and organic matter, as existing in the healthy bone, is reversed. The result is cartilaginous, weak, flexible bones, with rather enlarged joints. The spine bends; the breast bone bends; the head sinks between the shoulders; the legs curve out in all directions. Frequently the tibæ curve forward so that they are arched; and various other deformities occur.

In this condition, considerable can be accomplished by apparatus to keep the child's limbs straight; and by building up the child's strength with proper treatment, such as iron and cod-liver oil, tonics, nutritious food and open air.

Bones break sometimes, apparently spontaneously, but really as a result of tumors which are forming in them insidiously. This is especially true of cancer, or osteosarcoma of the femur, tibia or other bones. These occasionally give rise to what appears to be at first spontaneous fracture; and the force which breaks the bone is generally very slight — turning over in bed has broken a femur in the middle of the shaft in a case of unsuspected cancer, or osteosarcoma.

This form of malignant disease generally begins in the medullary cavity, grows and extends, rapidly absorbs and pushes out and thins the shaft or shell of the bone until it becomes so brittle that it gives way; and the cause is wholly, in these cases, malignant disease; so that in elderly people a case of spontaneous fracture, or fracture from insufficient cause, of the shaft of the bone should give rise to a great deal of suspicion as to what made it, and whether it is not probably due to commencing malignant disease of the bone

itself. In the shaft, I say, because it is well known that old people break the neck of the thigh bone and neck of the humerus from absorption of the bone, without any form of malignant disease.

Various tumors grow in bones, some of an erectile nature, which pulsate and are mistaken for aneurisms. They form in the medulla, rapidly accumulate a mass of enlarged vessels, throb and beat, absorb the bone just as an aneurism does, push out in a fungus pulsating mass, weaken the limb, and are recognized as a soft pulsating swelling about the femur or tibia, but are truly vascular tumors in the bone itself.

Myeloid disease also deceives us often in regard to the condition of the bone. It is true that myeloid disease rarely occurs in very young subjects; but its favorite site is the head of the tibia, and it forms very slowly; expands the head of the tibia; weakens the limb; gives rise to pain; generally to febrile symptoms; and is difficult to diagnosticate, at first, from caries occurring in the head of the tibia. Caries in the head of the tibia in young subjects is common; myeloid in the head of the tibia in adult subjects is not very uncommon. They frequently are mistaken one for the other. An incision, which seeks to relieve the caries and scoop it out, and falls upon myeloid disease, soon shows us what the mistake is; and in that case amputation is the only resort, and has to be done above the joint. The disease is incurable, malignant. Amputation should be done early to save the patient.

Now, it is necessary to know this sort of thing because it must give us great caution in operating, and in bearing in mind that we cannot tell exactly what we have got to expect when we operate on deep tissues; and that the alternatives

must be ready in our mind ; and that we must be prepared, and perhaps have prepared the patient, by saying, that we will endeavor to remove the disease ; but that we must do what is necessary in order to save life ; and if we find any incurable trouble, we may have to amputate.

XXII.

DISEASES OF THE JOINTS.

We begin to-day with diseases of the joints. I need not say that they are very common. Why they are so common seems to depend on two causes. In the first place, the parts around the joints are the centres of bony growth, epiphyses; consequently they are changing and only partially formed up to adult life. That would explain a good deal the tendency to disease in children. Again, in adult life, as in children, they are always centres of motion, always subjected to friction, always subjected to strains, to overuse; and they are the working centres, so to speak, of the bony frame, on which all the wear and tear comes, — causes certainly why, in susceptible persons, they so easily become the seat of disease.

SYNOVITIS.

Take the simplest form of affection about the joints which concerns only the synovial sac, — synovitis. In the simple acute form the progress is about as follows: The patient after a blow or strain feels a slight lameness in the knee-joint, we will say. There is pain on flexion and in putting weight on the joint. Very soon a slight puffing on each side of the patella. This expands soon afterward across the bottom of the patella under the patellar ligament, increasing symmetrically, forming an ovoid and finally fluctuating swelling, and lifting the knee-pan up from the joint. While this is taking place, of course the synovial sac is removed away from its

position around the bones. The muscle and fascia which are attached and prolonged into it lose their firm grip and bearing upon the bones themselves; and the joint becomes weak, and moves from side to side; and although it may not be the seat of great pain, yet the patient feels insecure, and is in constant danger of falling if he puts his weight on it. As the fluid increases the pain generally diminishes very much. During this effusing stage there is heat about the joint; and this continues during the acute stage; but after the fluid has been all poured out, after a few days, the heat and pain pretty much cease. The weakness of the joint remains. The swelling is very marked and characteristic. The patella, together with the quadriceps extensor, is lifted up from the front of the femur; and the result is what is called floating patella, and increased insecurity in using the quadriceps extensor muscle.

This disease may have various terminations. If properly treated and in a good subject, this fluid may be wholly absorbed again in a short time; in a few weeks, not in a few days. It goes away slowly, lingers last, naturally, at the bottom of the sac; and when it is nearly gone can still be detected by making the patient strip and stand upright and comparing the two knees; it is found that there is a manifest puffing below one patella, which does not exist on the other side. As this fluid goes down, it is apt to leave some thickening of the sac itself; and after the sensation of fluid is absent there is still a little doughy feeling about the joint. In the perfect restoration of the part this finally disappears, and the knee becomes as it was before; but in order to become as it was before usually several months are consumed. What is more apt to take place is that the fluid is absorbed to a certain degree; and then the latter portion of it is indolent; the

sac becomes slightly thickened, like an inflamed pleura, and finally slight fibrous thready adhesions are formed across from one side of the synovial sac to the cartilages and the bones; and what is called fibrous anchylosis results. If now this goes on, finally the fluid is wholly absorbed. These threads shorten and become firmer; and what is called false anchylosis, a stiff knee, stiff by fibrous attachments, is the result.

On the other hand, acute synovitis may pass into the chronic form. In that case the patient frequently has recurrent attacks; has his acute synovitis; has it restored to a certain degree, and then the joint puffs up again; fluid reforms; and the fluid is slow in going away the second time, if it can be noticed to go away at all. The reason is that successive inflammation of the synovial sac renders it incapable of absorption, and the knee becomes bathed in an indolent fluid of serum and perhaps some fibrin; it is not absorbed, and forms the condition called chronic synovitis; sometimes called dropsy of the knee-joint.

The treatment of acute synovitis to be best should be immediate. Unfortunately the patient does not generally apply to the surgeon or physician until the disease has existed some days, and effusion is already well formed. Immediate confinement in bed or on a sofa should be insisted on; the limb put on a ham-splint, so that the joint may be restricted in motion; and yet the front of the knee-joint left uncovered, so that it may be treated. At first it should be treated with cooling and evaporating lotions during the early inflammatory stage; later with more stimulating applications, like blisters and tincture of iodine; and finally by pressure; and pressure and firm bandaging will usually complete the cure. This all takes several weeks. Afterwards the patient should be instructed to wear a flannel bandage a number of weeks;

to use the limb with caution; carry a cane; and be careful not to strain the recently healed parts, so that any other effusion may take place. This usually suffices to cure an acute synovitis in the healthy subject.

The chronic synovitis, on the other hand, is extremely obstinate to treatment; and although we rest it; put it on a splint; apply blisters, iodine, etc., yet the fluid sometimes does not go away. Under these circumstances the judicious application of continued pressure is of great benefit; and this should be applied in one of two ways. In the old way,—still a very good way,—by putting on dry compressed layers of sponges, wetting them and making firm compression on the whole synovial sac. After this has done its work and is beginning to loosen, reapply. In this way a strong uniform pressure is got over the sac, and the result is to gradually absorb the fluid by compression.

Another method, which is more ready and perhaps as good, is to apply around such a joint a rubber bandage which can be put on and the patient strictly confined to bed. That can be readjusted from time to time, and firm pressure made on the joint.

Still there sometimes remain obstinate cases of dropsy of the knee-joint which are indolent, painless, free from fever and irritation, with no signs of absorption. In such a case as this, tapping of the joint may be done with advantage; and aspiration having been used, the joint can be pumped off by the vacuum, and pressure put on. If this measure proves insufficient and fluid afterwards re-forms, a second time we may tap and draw off a portion of the fluid, and inject into the joint some irritating preparation: tincture of iodine, a preparation of ammonia, a weak solution of carbolic acid, or something of that kind. Absolute alcohol has been injected

with a good deal of benefit. This lights up an inflammation; converts an old chronic dropsy into a pretty lively synovitis for the time being; and after that has subsided, we put on pressure, and by subsequent bandaging lead to the absorption of the fluid.

In a person not strong we always have a dread that an acute synovitis, if not promptly cured, may lead to something worse; and that something worse is the change in the synovial sac described by Brodie as pulpy degeneration of the synovial membrane. The change takes place in the inner lining of the synovia, where it becomes thickened and roughened; and softens and undergoes a change somewhat like that undergone in the arteries in atheromatous disease. Bony plates are not formed; but ulceration of the surfaces; fatty degeneration and formation of flakes of fibrin; and such a change in this membrane that it is impossible for it ever to wholly recover. In these cases we find the young subject with a permanently altered joint as to its usefulness. The natural outlines of the joint are lost. The patella is no longer distinct. The sulci on either side cannot be made out. The shape of the joint is still entirely symmetrical, alike on both sides. If it is alike on the two sides it means disease in the synovial sac; if on one side more than the other, it means disease outside the synovial tissue, or else inside of the bone. The joint becomes spindle-shaped; the muscles above and below waste to a certain degree; the shape of the joint is lost. It is doughy; not hot to the touch, particularly; slightly painful, and remains in an indolent state. It cannot remain in this condition without some subsequent change; and the next change which takes place is that the effusion which was present in the joint gradually degenerates, and finally, incapable of absorption and subject constantly to friction and

motion, and also subject to the influences of a feeble constitution in the patient, the fluid becomes changed into pus, and suppuration in the joint takes place. Now occur fever and chills and sweats and pain, all the phenomena of hectic. Finally the joint begins to lose its symmetrical appearance; swells on one side or the other; reddens; becomes acuminated; thins and bursts; and we have suppurating disease of the knee-joint, with a sinus leading into it, and the constant discharge of pus.

ULCERATION OF CARTILAGE.

We have another form of disease of the joint, called ulceration of cartilage. By that we mean decay of the cartilage.

The cartilage is an extremely lowly-organized body, nourished mainly by imbibition from the neighboring vessels and tissues. Its nutrition is never at a very high point. It easily falls into decay, and anything which affects either surface of the cartilage from the sides where it gets its nutrition, cutting off the supply of blood and the proper absorption of fluids into it, may lead to its decay: hence decay or ulceration of the interarticular cartilages, or the articular cartilages of the bones may arise, on the one hand, from the diseased synovia bathing it in a purulent secretion, and preventing its nutrition on that side; or it may arise from the disease beginning in the bone itself, whereby its nutrition on the side where it clings to the bone is cut off by occlusion of the vessels. In the first place, it is due to suppurating synovitis; and, in the second place, to disease of the cancellous tissue of the epiphysis of the femur or tibia; and frequently that, also, is of a tuberculous origin. Tuberculous disease, cheesy degeneration in the cancellous tissue of the head of the bone, soon affects the overlying cartilage, cuts off its nutrition, and leads to its

ulceration. The result is, that as this diseased condition goes on in the feeble subject, that the cartilage loses its lustre and becomes yellow and dull, flattens off; a portion decays and drops into the joint. If the disease is going on on both sides, erosion takes place rapidly; and in the advanced state we find only shreds of cartilage lying about the bone, and the cancellous tissue of the bone already exposed, and rough and carious.

So far, then, with the exception of tubercle, every change we have described is in the joint and symmetrical, and outside of the bones themselves. All these changes, then, for example, would be accompanied by no change of shape of the bones whatever, and, were we to judge by the bones alone, we should not say that the joint was diseased in the slightest particular.

I will speak now of the other series of changes which begin in the bones. When tuberculous degeneration or any change begins in the epiphysis of the femur between the two condyles it leads to a congestion, and then to inflammation and effusion of false products into the cancellous tissue. This gives rise to dull, aching pains which are persistent in character, to elevation of the temperature in the joint itself, and to the usual symptoms of hectic. The most peculiar change which takes place, which may be noticed by the outside observer, is the expansion of the bone itself; and the end of the femur visibly grows, enlarges, and broadens under observation, so that from being normal it widens out, until it is immensely enlarged on one side or both, sometimes more on one side than on the other, frequently more on the inner than outer condyle, until there is a larger bulging of bone over the inner side of the condyle of the femur. This means bone disease, an ostitis going on

in the cancellous tissue, a softening and caries taking place there, generally from a tuberculous deposit. The pulpy degeneration of the synovial membrane, which follows in the scrofulous subject, in acute or chronic synovitis, and the ulceration of cartilage, which is the next stage in the diseased process, and which is, in consequence of the cutting off of the nutrition of the cartilage, eventually leading to suppuration and change in the joint, and finally to disastrous disease — all these forms of disease have been called, among the laity, by the common name of white swelling. White swelling, in popular parlance, means chronic synovitis affecting the sac, the cartilages and the bone, generally of strumous origin, and finally resulting either in anchylosis or abscess. The reason of the name was probably because it is a swelling of the joint which does not change its color. It never reddens until the acute process has burst through the sac into the cellular tissue. It is a pasty, pale, œdematous, soft tissue, which retains the imprint of the finger about the joint, has lost the true shape of a joint, is rather free from acute heat or inflammation, and is in this chronic strumous state which will end, probably, in suppuration, ulceration of cartilage, abscess in the joint, caries, anchylosis, if cured; excision, or amputation if not cured.

Still another change, a very curious one, takes place. After the sac is altered, these diseased fluids poured out, cartilages eaten away, bones become carious, still inside the sac are shut up pus and decayed products; if acute abscess does not take place on the outside, the joint still retaining its contents to the last, by and by another change begins to be observed in the knee. It is spontaneous dislocation of the head of the tibia back of the femur. The disease has gone so far, it finally attacks the ligaments,

loosens them; and the power of the long muscles pulls the tibia backwards and dislocates it almost entirely behind the condyles of the femur. In such a joint as this you find a peculiar shape beginning to develop in the front of the joint. The outlines originally lost and indefinite become more distinct. The patella stands out, the condyles of the femur stand out. You will see, on close observation, that the tibia is no longer on a line with the femur, and is dropping back; and the condyles and the patella are projecting out over it at a sharp angle. This change goes on further and further; and in very old, crippled subjects, who have had this disease a very long while, instances are found where the tibia is absolutely dislocated backwards into the popliteal space, the limb shortened, and the femur thrown entirely in front of the lower bone. Usually it does not go so far as that.

If a moderate and partial dislocation, it is still capable of spontaneous cure. After a term of years, without the occurrence of any external discharge of pus, inspissation of pus takes place, the formation of fibrous adhesions, the formation of bony adhesions, and finally, cure results, with a partial dislocation and a firm, bony anchylosis.

This bony union is called true anchylosis, but is not necessarily accompanied by dislocation.

What are the symptoms of this graver class of diseases? We have seen how insensibly in the bad subject they shade off one into the other, usually pursuing a line of well-marked steps or stages of gradual degeneration of the part. We have said it is quite easy to recognize an acute synovitis. The swelling is great, fluctuation is considerable, the disease is painful, the cause is quite evident, the patient is fully aware of what is taking place and the diagnosis is

practically made with great facility, and a mistake perhaps is seldom made. Not so with these insidious stages of chronic synovitis, for the symptoms are slight and obscure, and they continue for months, perhaps, before the attention of any one is called to them. One great reason for this is that both in the knee and in the hip they occur largely in young children, too young to tell their symptoms, and indifferent, as children always are, to bodily suffering, providing they can keep about without having to lay up, and play around with their companions, under the emulation that always exists at that age. Children are very peculiar in this respect. They, of course, never simulate disease; never have hysteria or mimesis. They do not pretend to have what they do not have. It is only by sharp observation that you can find out in the little child that something exists which is pulling him down. In the knee-joint, for example, if the disease begins as pulpy degeneration and ulceration of cartilage, slight limping; favoring of the limb; bending of the knee; not carrying it quite straight; favoring it by walking on the toe; occasional attacks of fever and pain; starting pains at night. These last are the most characteristic signs of articular disease at all ages. They occur from the spasmodic contraction of the muscles after one falls asleep; and they occur also after amputation, making a painful jumping of the stump, after the limb is gone. The control of the muscles is lost in sleep. A spasmodic action of the muscles occurs, and the child wakes from pain, and falls asleep again. This occurs from diseases of joints; those affecting the synovia, the cartilages and the bones; and it does not occur usually in the simple forms of synovitis; and does not occur in the series of joint diseases which are hysterical, or mimetic. The signs then of this condition

are insidious. We have a little limping, a little bending, yielding of the foot, a little change of shape, slight attacks of fever, frequent starting pains at night, and if we look at the joint it is somewhat altered in shape. Still more insidious are those changes where tuberculosis begins in the bone itself and expansion takes place in the condyles of the femur and the femur grows out on either side; and the child also limps slightly, bends the leg slightly, and has a certain amount of pain. You will frequently see children at the out-patient departments who run along with a slight limp, without good motion of the joint. Examining the two ends you find a great expansion on one side, not present on the other. At a later stage when suppuration has taken place and abscess is about to form, the symptoms become extremely severe and intense up to a certain point, and then are promptly relieved on the bursting of the abscess itself.

So much for the diseases of children and youths and young adults. Now the old people have their peculiar diseases of the joints which are very characteristic. We know that most of them are ascribed to rheumatism or gout, and with justice; but besides these there exists in the old a form of chronic arthritis which has sometimes been described as senile hip disease. The hip disease of old people is a matter of months, or years. The leg slowly shortens; the shape of the part changes; the joint still moves to a certain degree, but is stiffened; there is constant pain and lameness; and the patient, although accused of having had a fall that they may never have had, manifests all the signs of shortened femur, and goes about with increasing symptoms of hip disease, during the remainder of life. They are essentially cold inflammations; and the changes which take place are those of softening and absorption, rather than of acute suppura-

tion. On the other hand, the very large class of diseases in the joints of old people which are due to gout or rheumatism are marked by very peculiar and easily recognized symptoms. The chronic rheumatic arthritis, or rheumatoid arthritis, in elderly people, is characterized first, by what is called a dry joint; the joint creaks and snaps on motion. This is especially true of the knee. The patient sometimes may be heard in the house walking down the stairs, while the patellæ snap upon the front of the femur. Similar creaking and rubbing takes place in the hip; in the bodies of the vertebræ; or in other joints. The shoulder becomes roughened and cracks on motion. This change is due to gouty deposits on the articular surface of the joint itself. The joint surfaces become roughened; bony growths take place; fringes of little osteophytes grow about the articular surface; and creaking and rubbing take place which simulate exactly the crepitus of a fracture, no injury, however, having occurred. The patient being at an age to have this disease, we may diagnosticate this bony affection as chronic rheumatic arthritis. The joint is dry, rubs and grates; motion is restricted; anchylosis does not always take place; but restriction of motion to a very marked degree takes place, so that finally the patient becomes unable, perhaps, to get the hand up or behind the head, but can still make the to-and-fro motions in the joints. The motions of the knee and hip become restricted. These patients go on through life and die in this condition, lame, stiff, disabled; but the disease does not reach any higher grade of destructive process. Occasionally nature makes another change, which is very remarkable; and after they have been rough and crackling sometime the knee gets smoother and works better, and eburnation or ivory-like polishing of the surface

takes place. The cartilage is gone; the bone is smooth and hard and rubs against another surface without the intervention of cartilages; and a species of smooth polishing down, without much synovial assistance, is made, and the patient moves about pretty well.

NEURALGIA OF THE JOINTS.

It is rather hard to say what it is. I believe it is almost always due to some unsuspected and unrecognized diseased condition of the bone itself, in the neighborhood of the joint. For example, a person too far advanced in life, and too active and of too many interests in this world to be suspected of wanting to lay up, complains of constant lameness in the knee. It is always located in one spot; shows nothing outside; you can feel nothing; appreciate nothing; no swelling, heat or change of outline, but an everlasting boring pain in the inner condyle when he gets tired; which obliges the patient after a half-day's work to come home and rest his leg on a sofa, when the pain gradually subsides. It is probably due, so far as we can make out, to gouty changes in and about the joint itself; and just as in the arthritis deformans, so about the femur and in the larger joints, occasionally, gouty deposits take place, which are the seat of pain; these are probably chalky deposits, which are not sufficient to throw the joint out of position; but are the subject of constant painful frietion, after the patient has long used the part.

A very large class of supposed diseases of the joints are due to an hysterical condition. They generally begin in the young and susceptible subject; not always a female, but often females; in consequence of a real injury. The patient gets hurt a little, not much; but she does not get well. When the time has passed for the effect of the bruise or

slight synovitis or blow to be cured; when you think you can take the knee-joint and move it; and she says she cannot stand upon it; and cannot move it herself; and you can detect no ostensible disease whatever, you have got to suspect that the disease is in the mind, and not in the joint itself. It is what is called hysteria, a very false name. It has nothing whatever to do with the uterus. It is better called mimesis or simulation; not always conscious simulation. The patient may be perfectly honest, and self-deceived, on account of this peculiar mental tendency; weakness of will; the imaginative faculty, which is in excess. They get into a condition when they believe that the joint is diseased; that they cannot stand on it; that it is going to kill them if they get on it; and the longer this delusion exists, the more helpless becomes the joint. Finally, in such cases, unless relief can be given in some way, the patient, who cherishes this illusion, takes to her bed, and becomes what Dr. Channing described as the bed case; and nothing gets her up, except something which appeals more strongly to her imagination than the surroundings in which she is. If there is a fire and the bed gets on fire, she will get up and go out. If influences of a hypnotic or spiritual kind are brought to bear, she may be immediately cured. If she can be shocked to get up, or induced to get up, she may be cured; but unless her will can be in some way got hold of, she does not make that effort; and the limb remains, what is called, an hysterical joint. Brodie, who practised among the wealthy and indolent classes in the latter years of his life, says hysterical joint disease was very frequent; and a majority of cases of joint disease he saw in the young were purely mimetic, and not real. In these cases the difficulty comes in making the diagnosis. We all know that organic disease may be behind these manifestations. Pa-

tients thought to be hysterical may be found to have internal cancer. We must be as sure as possible that the diagnosis is correct; and exhaust every means to try to find it. Try such a limb with the electrical current; test it carefully as to its temperature; have careful watch kept in the patient's sleep, to see whether she ever has those painful, nightly shrieks, which are almost pathognomonic of disease of the joint, and do not occur in the simulated variety. When the joint keeps the same temperature and shape and appearance, and the only change about the leg is that fatty degeneration is taking place in the muscles with wasting; meanwhile, the patient looking and remaining in perfect health; keeping a good complexion and a pretty good color, and only yielding to this peculiar condition of the joint; we may then be pretty sure that it is due to a misplaced effort of the mind; want of will; error in the imagination. It is a species of insanity, and should be treated with charity; but the cure will be brought about by mental treatment, and not treatment of the limb itself. Such a patient should be encouraged in every possible way to get up and try to put the weight on the limb. One may perhaps induce them to do so by the aid of crutches; massage and gymnastics are useful. Passive exercises may be given by other persons while the patient is lying down; and finally, perhaps, the patient may be persuaded to resist against the hand of the rubber, and make motions herself. If she once finds out that she can do that, the cure commences. Electricity is of great assistance. In addition to this, diversion of the mind; if the patient can be carried out of doors, amused; led to forget herself; and brought on from stage to stage, until she can be cured. More depends, I am inclined to think, in the treatment of this class of cases upon the personal magnetism of the individual, than anything else. Some

people have the power of impressing those with whom they come in contact; of preserving always a certain belief and confidence in their assertions; and finally lead the patients out of their beds, and on to their feet, so that they walk. The most unfortunate thing which can happen is to remain at home and be surrounded by a set of sympathizing friends, who believe in the reality of this false disease; who encourage every supposed pain and ailment; who shrink from anything being done; and unless the patient can be removed from such surroundings and started anew, frequently a cure is almost impossible. These cases, as I say, should be treated firmly; but they should be treated charitably; for they are practically and really a disease of the mind, and should be treated like other mental affections. Most of them, sooner or later, get well. Sometimes they take a year or two, sometimes some years. Occasionally one remains permanently through life; and such instances, of course, are very painful, because as time goes on it is evident that there is no disease; because the patient does not alter; no change in the joints; no abscess; no anchylosis; no formation of cancer; no pulpy degeneration; and the patient remains bedridden, but perfectly well.

HIP DISEASE.

Hip disease is one of the more marked diseases of the joints. It most frequently comes in children, fortunately, because in children it is capable of cure; and in adults it is not; unless the spontaneous stages of the disease have been gone through and the diseased condition terminated by the time puberty comes on; so far as my experience goes, the patient never gets well if the age of puberty is passed, and the active changes of hip disease go on; they last then through life, or until they destroy the patient.

This disease is supposed to originate in two different ways. Undoubtedly it does, like all the forms of which we have spoken, originate in two ways; beginning in the synovial sac, or in the head of the bone itself. It may begin as a chronic synovitis, with pulpy degeneration of the synovial membrane and ulceration of the cartilage, from cutting off of nutrition from that side of the cartilage; or it may begin as a tuberculous deposit in the head of the femur, and from want of nutrition from the inner side, lead to erosion of the cartilage; abscess, and all the phenomena of hip disease.

The symptoms which present themselves first are, usually, that the child begins to throw out the foot of the affected side a little more than the other side, as it walks. The limb is apparently lengthened. The child limps a little as it walks. It does not complain of much pain. No changes have taken place about the joint which give any characteristic appearances from the outside. As the disease goes on a little further, more pain is manifested; inability to walk with any freedom; and, after a while, the position of the limb and foot changes, and apparently a little shortening takes place. About this time the child usually becomes very sick, and an acute fever supervenes, with intense pain in the joint; the child lies in bed with the limb drawn up towards the abdomen to relieve and relax the part. The parts all about become shiny and thin and change in shape. The fold which exits normally between the buttock and the femoral muscles is lost. The hollow in the groin becomes filled up, so that the diseased side is full and flat; and, in addition, intense nightly starting pains with hectic; rise of temperature; sweats, chills, etc.; and then sudden and immediate and perfect ease. The child turns over, begins to laugh, feels better, wants to get up. The explana-

tion is, that the earlier stages, marked by such extreme suffering, were those of an abscess distending the synovial sac to the point of bursting. Finally it bursts; pus pours out into the cellular tissues; the pain ceases; all symptoms are relieved, and there is a great remission in the course of the disease. This remission, however, is not of long duration; and after the child gets up it is soon found that dislocation of the femur takes place; the foot is turned in opposite the other; shortening of one and a half inches occurs. Another attack of fever comes on. The child goes to bed; is sicker than before; the hip becomes shiny; abscess bursts and the pus escapes externally. Relief of symptoms again follows. The child gets up and goes around with a stick or crutch, with dislocation on the dorsum; inverted foot; and the disease goes on through its other stages, which are chronic caries; and if cure can occur, finally, drying up of the abscess, and bony anchylosis on the dorsum of the ilium, with the head fastened in its new and false position.

XXIII.

HIP DISEASE. — POTT'S DISEASE.

You must conceive, of course, that these lectures are mere outlines; and when you see the large books that have been written upon these special deformities, and reflect how much the student has got to carry in order to learn all that is known on any given subject, it seems to be rather discouraging; but our business is merely to mass together certain facts, to draw outlines, so to speak, which you can fill in afterwards; and, therefore, if a great many details are omitted, you must expect that you can only get the principal things firmly fixed in your minds, and that is all that I attempt to do.

In speaking of hip disease, I said that the earlier symptoms of the disease were the slight limp, eversion of the foot, apparent elongation of the limb, and that, soon after, this gave place to more marked lameness, drawing in of the foot, evidently inversion of the limb with decided shortening, this marking the completed stage of the disease. In the earlier stage of the disease the diseased condition begins in the synovial sac, or it begins in the head of the bone. In one case it proceeds to the pulpy degeneration of the synovial membrane, ulcerating the cartilage and finally affecting the bone; and in the other case it starts as cheesy, tubercular deposit in the head of the femur, destroys the cartilage by its contact with the disease and the cutting off of its nutrition, invades the joint, converts it into an abscess,

bursts through the joint, and finally ends in dislocation of the bone. The child, at first a little lame, now becomes a great deal more lame, and shrieks out with pain at night. After a period of great feverish excitement, a space of time follows in which there is entire relief, and the child seems better. This coincides with the bursting of the abscess through the capsule of the joint, getting rid of the tension and relieving the extreme symptoms of pain and fever. Subsequently to this inversion and shortening of the limb, another period of fever comes on, marked by the progress of the abscess into the cellular tissue, finally breaking through a small opening through the skin, and this again followed by a period of relief. The shortening and inversion which take place at this period are due to dislocation of the head of the femur, which occurs as perfectly on the dorsum of the ilium as if it were in consequence of violence. In other words, the ligaments have given way, the joint being disorganized, synovial sac ruptured, the head is pulled out from the socket, thrown out on the dorsum by the powerful action of the muscles, and shortening of one and a half to two and a half inches, with inversion of the limb, takes place.

Subsequently to this, nature pursues one or two courses, usually the latter. The first course would be to try to establish a new and false joint on a new part of the bone, the head resting on the dorsum. The other and more common termination is to establish anchylosis — absolute bony anchylosis between the diseased and wasting head of the femur and the false socket, surrounded with osteophytic growths, on the dorsum of the ilium. This is the usual termination. The child who goes through all the stages of the disease from the first synovial inflammation ends with anchylosis, with the head of the femur against the dorsum

of the ilium in the characteristic position of dislocation of the thigh upon the dorsum of the ilium. Sometimes, in fortunate cases, this is all the deformity that ensues; but in many other cases, on account of entire neglect of treatment in keeping the limb in the proper position while these changes are taking place, the patient yields to the natural impulse to relieve suffering by drawing up the leg. The leg, then, is not only shortened by the disease, but the knee is drawn up and shortened by the efforts of the patient. In addition to this, powerful adduction takes place, so that, in extreme cases, the deformity is great, the head of the femur being dislocated and the leg shortened, and the knee drawn up nearly in contact with the abdomen. These are the extreme cases of deformity which afterwards result in anchylosis, with a perfectly useless limb; the child walking with crutches upon one foot, and the other foot wasted, and carried high (in the air). This is the natural course of the disease if it pursues all its stages. It does not necessarily, however, pursue all these stages, for sometimes it becomes arrested in its progress, and then, in some very favorable cases, the disease may be made to stop short of dislocation, and in some cases, probably, stops short of real abscess; or if slight abscess exists, it does not become enough to burst the capsule, becomes inspissated and absorbed, and the child gets well. The head of the bone altered somewhat, but still inside the socket, and fastened by fibrous if not bony adhesions. That is in the mild cases.

Inasmuch as treatment, to be effectual to arrest the disease, must be applied at a very early stage, it becomes important to know what are the exact diagnostic signs of this disease when it is first beginning, for it is in the very early stages only that we can do much good.

Lameness, limping and pain moderately marked, usually concealed a good deal by the child. The hollow of the back is very peculiar. The child, laid down on a table, arches the back in such a way that the hand can be readily passed under the small of the back without touching the back. On examining such a child and comparing the two sides, it will be found that the first noticeable change is a loss in the sharp contour of the line of the groin which separate the femur from the abdomen and pelvis; and next to this a wasting of the glutæi muscles, due to disease, and a consequent loss of that sharp fold which marks the division of the lower edge of the glutæi from the posterior femoral group of muscles; in addition to this, an increased prominence of the greater trochanter of the femur. If now the two joints of this child are examined, first the hip of the well side and of the diseased side, a marked difference will be found. In case of a healthy femur, we may take the femur and rotate it almost as freely as the humerus without eliciting any movement on the part of the child. The moment we touch a diseased limb we have a joint locked by the muscles, firmly held by muscular spasm set up at once by nature the moment we touch the limb in order to avert the chance of suffering from moving the diseased joints upon each other; and although the child may go about with a moderate amount of motion in these cases, yet the suddenness and completeness with which nature will lock the joint when it is seized and attempted to be moved is a very significant fact. We find a limited motion. We find that the movement which we are making is moving the pelvis as well as the femur; that there is an anchylosis which is false, and which under ether, is shown to be absolutely false, but which demonstrates the great difference between the diseased and

the healthy side. I do not think that this muscular spasm and anchylosis is ever wanting in the well-marked case; and that, together with the loss of the fold in the groin, flattening of the nates, arching of the back and stiffness of the joint, are the very early diagnostic marks of the disease itself. Direct pain by pounding about the joint is not generally elicited, except in the advanced state. Grating or rubbing in the joint itself is almost never elicited unless the patient is not only etherized, but in a very advanced stage of the disease; and even then it is seldom got, for the reason that, although the cartilages give way, and you would think the bony surfaces would be brought in contact, yet nature has protected them with a bed of velvet-like granulations, which cover all the diseased surfaces, and prevent them from rubbing together with a crepitus like that of diseased bone. No motion can be got without ether, and with ether the signs of crepitus are not usually to be found. Of course, when abscess has taken place, when dislocation has taken place, we can hardly mistake the disease for anything else, provided we can eliminate any violent accident or injury, which might have caused the dislocation or the abscess from traumatic reasons.

Given a slow-coming-on disease with these phenomena, it means hip disease, and the child will present other signs of tuberculosis in its system, in its features, in its nails, in the eye-lashes, in the shape of the lip and a wasted condition, which speedily shows a state of chronic scrofulous disease. So much for the symptoms and the diagnosis. If nature is left alone in the favorable case, she produces a cure by anchylosis. If this disease has begun early enough in life, and runs on fast enough to complete its stages before the period of puberty is reached, a cure by anchylosis, with

entire healing of the sinuses, and subsequently a strong limb, are frequently the result. If, on the other hand, the disease starts later in life, or does not conclude its three stages by the time puberty has come on, then usually the disease remains permanently; and although partial anchylosis may take place between the femur and the ilium, still sinuses are apt to occur, caries is apt to go on. The sinuses may heal and the patient go on a few years, and then, after some sudden exposure, it breaks out again from the old opening. There is a new discharge of pus, a new attack of pain, and new evidence of disease in the joint. This is especially the case in males after they have received a slight sprain or injury, or exposure to cold, if they have grown up with hip disease imperfectly cured; and, in females, it is quite liable to follow the condition of pregnancy, where, after childbirth, the diseased condition is again lighted up, abscesses reopen, and the old trouble about the joint asserts itself again.

As to the treatment we can employ. It must divide itself into a number of stages. The most effectual in the early stages; the less effectual mode of treatment in the later stages. In the early stages, the moment these preliminary signs are detected, it is essential at once to obey the voice of nature, which teaches us by the muscular spasm that she is making every effort to keep the joint at absolute rest. That is the first and great essential of the treatment of hip disease. The patient should go to bed and keep still. The bed, with extension, is the first treatment of hip disease as soon as it is suspected; and this should be continued until the nightly cries and pain and such symptoms are gone. Frequently in these early cases six weeks in bed will suffice to overcome all the active inflammatory symptoms. The joint becomes almost like the other. The patient is

apparently almost relieved; and when that appears, then we can venture to let them get out of bed, and not before. The moment they get out of bed they must be supported by another form of extension, by a splint; which can be applied in such a way that the patient walks on the perineum. I will not describe the apparatus used for this purpose. In addition to this it is of extreme usefulness to oblige the patient for a while to go on crutches; to put on a high shoe on the sound foot, which forces them to keep the sick foot up in the air. The child can get about in that way freely; with extension kept up, so that the diseased bones do not press and churn upon each other. This mode of treatment must be continued a number of months. When you are convinced that another stage of the cure has arrived, you can venture next to take off the high shoe; keep on the splint, and allow the patient still to go about on crutches, and put weight on the limb. Eventually crutches are discarded and the splint alone used; and finally, after a long while, several years, the patient may be trusted to go without anything; and, if fortunate, you may have succeeded in arresting the disease. All this treatment, provided the disease does not go on to abscess, can be continued without suffering, or interfering with the health of the child. Although we consider it bad policy to put one of these feeble children to bed and shut them away from good air; yet we have got to balance this against the rest and ease and absence of fever we shall produce by extending the limb and keeping the joint still; and the moment the early inflammatory stages are passed, the child can be got up and out of doors, and put in the healthiest possible circumstances. Tonics, of course, should be used to build up the child's health.

When abscess comes on before treatment, or in spite of treatment, extension is badly borne. When abscess is forming, and before it has burst the capsule; when it is re-forming and trying to make its way into the cellular tissue; extension produces no relief; but produces terrible pain and has to be abandoned. In such a state we must content ourselves by allowing the patient to lie still in bed; apply soothing applications to the limb; wait for the giving way of the abscess at some point; and try to keep the limb down with a gentle splint into as good a position as we can while these inflammatory changes are taking place. When the abscess has burst, or is evacuated, extension can be again applied. Now is the time when nature is about to pull the bone out of the socket, and the time when extension, if kept up vigorously, may avert this; or diminish the extent to which nature will get the advantage of the bone and draw it up on the dorsum. In these cases where abscess has formed, where dislocation is bound to occur, extension in bed by weight and pulley becomes of vastly more consequence than before. A good deal of weight should be put on; the parts held as still as possible; perhaps the child held down in bed by some brace or confinement; and if the child does well; if it does not suffer; if its constitution holds out; unquestionably that is the best mode of treatment for some months until the tendency to dislocation has subsided. Then a splint can be used; and the treatment continued, for several years, in the way described. Supposing the disease has gone through all its stages and made spontaneous cure by bony anchylosis with the head in contact with the dorsum of the ilium and the limb in an extremely deformed condition, so that the foot cannot be got to the ground, the legs cannot be separated

at all, and the limb is wasted and useless; two alternatives present themselves; one is to saw through, or cut through, this anchylosis, or rather through the neck of the bone below the anchylosis, to draw the limb down into place, keep it there in splints for a considerable length of time and to expect union to take place at the point of section in the limb, in a better position; or in some rare cases we expect a false joint. Probably union in the new position is the most favorable result we can have. The only other alternative in this class of cases, or in cases where the disease is still going on actively with abscess and caries, great shrivelling of the limb and uselessness — the only other alternative is amputation at the hip-joint; which, if the patient survives it, cures it. It takes off this mill-stone which is dragging the patient down. Restoration to health and a fat, strong condition is usually the result. Formerly this could hardly be thought of, on account of the immense mortality of amputating at the hip-joint. Now it may be done with comparative safety by the new method of amputating, where great loss of blood is avoided. The vessels are best secured by the figure-of-8 rubber twist held by an assistant with a firm twist which can be tightened; and the limb is amputated, not by the old French method, but by the slower process of excision; and amputating the remaining portion of the thigh by the circular method. By this mode of operating the child loses very little blood; and if in a sufficiently strong state to stand any operation, will recover promptly and get a useful life afterwards, with a useless limb taken away.

The other point of which I wish to speak is as to operative interference in the earlier stages of hip disease. That

operative interference means either opening abscess, and cutting down and tunnelling out and gouging the diseased bone; or doing a still more marked operation, and endeavoring to excise the head and neck of the femur; endeavoring to scrape the acetabulum, if necessary; and allowing the patient to recover with what is called a false joint. The operation of excision of the head of the femur was formerly much more popular than now. In the first few years I was on duty at the City Hospital I did the operation a great many times and published a good many cases; and thought I obtained, sometimes, very excellent results. More mature experience has proved that these results are not so good as they first were thought to be; and the operation is not to be resorted to, provided the patient can be trusted to make a spontaneous cure. The arguments used in favor of excising were these: that you hastened the progress of cure; took out the diseased portion; gave thorough opening and evacuation of the abscess; and made a more useful limb and joint. The most useful limb the child with hip disease can have is with a moderately well-placed anchylosis with the femur fastened to the ilium. That once firmly bridged over and solid, no subsequent disease affects it; and it is a strong limb which can be used without fear and without pain. The great deformity which was thought to be unavoidable, in former times, not only from shortening, but from inversion, is now known, as the child grows up, to be largely overcome by subsequent mobility of the ankle and knee, and of the pelvic joints at the sacrum; so that I have seen many of these cases where they were not touched by the surgeon, where the patient could walk very well indeed, and without the inversion which was thought unavoidable. That takes away one of the arguments in favor of excision. If

you excise, you get fully as much, if not more, shortening, than if you trust to spontaneous cure with the head of the bone on the dorsum. Excision means two to two and a half inches of shortening always; and the subsequent joint is a loose joint. It is not so reliable. It is flexible, but not so firm; and it is liable to recurrent abscesses, and to continuation of the carious processes in the shaft of the femur. You cannot cut off much without making a useless limb; and there may still exist a tuberculous focus. After excision this may follow; that although you have taken off all the disease of the head of the bone, still there remains a tubercular condition of the acetabulum; which afterwards goes on to disease of the pelvic bones and defeats your object.

In addition to this there is another argument against great operative interference in hip disease, and against opening up medullary cavities; and that is the chance of rapid dissemination of tubercular material throughout the system from any severe surgical operation. Of course, many children with ordinary hip disease will die of tubercle in other parts of the body; will have tubercle in the mesenteric glands; in the membranes of the brain, or amyloid degeneration of the liver and kidney; so also they will have it in many cases with excision; and sometimes, to my surprise, it has become developed with such rapidity after excision that it seems as if the operation had started a new process of dissemination throughout the body. It seems to be pretty well conceded that the successful treatment of hip disease is the mechanical treatment; that the earlier you get at it the better the result; and that operations should be reserved for two classes of cases; that operations to saw the bone

and replace the limb in a new position should be reserved for those cases where there is anchylosis with such deformity that the patient cannot walk or stand or use the limb in any direction; and that formal excision should be reserved for cases where there is no prospect of cure by anchylosis, and where you may do something by cutting open the parts freely; scooping out the disease, and subsequently closing the wound.

In operating, you have an immediate mortality which is considerable. I have seen several patients die within the first forty-eight hours after excision; and if you get the most perfect result, you have a swinging joint and no more useful limb than before. There can be hardly any doubt, I think, that while surgery ought to interfere in advanced cases, where the child is dying of hectic and suppuration and caries; and that surgery ought to interfere in cases where the limb is so deformed that the child can neither stand nor sit; that in other cases it is safer and wiser to follow the dictates of nature and seek her method of cure, which is by anchylosis.

Early diagnosis and early treatment are the best here, as in all acute diseases — in any disease, I do not care what it is. In any acute disease, which is threatening, you accomplish more in the first twenty-four to forty-eight hours than in the subsequent weeks; and in any acute disease of bones and joint you accomplish more in the first few weeks than in the subsequent months.

The main thing is to keep the joint at perfect rest; to restore it to its natural functions very slowly indeed, and with extreme care; and subsequently, if dislocation and anchylosis take place, to try to keep the limb in as good a position as possible; and to expect, if these stages can be

gone through with before the age of puberty, that we shall get a permanent and spontaneous cure.

POTT'S DISEASE.

The next class of diseases of the joints that we shall take up are those of the spine; and as we are on the tubercular and suppurative class, I will proceed to that which is called Pott's disease, or caries of the spine.

In the specimens passed around, it will be seen that the disease generally begins between the bodies of the vertebræ, in the intervertebral cartilages; that it is distinctly a joint disease. It may proceed as an ulceration of the cartilage, finally affecting the bodies of the vertebræ, or may begin, occasionally, in the bodies of the vertebræ themselves, as a tubercular deposit, affecting and destroying the cartilage by cutting off its nutrition; then leading to erosion of the bones, and to abscess and the deformity, humpback, which we recognize as characteristic of Pott's disease of the spine. Some authorities have gone so far as to say that caries, or Pott's disease of the spine, is the result of injury; that the child gets a fall which injures its back; that the fall produces the disease. On the other hand, most authorities seem to be agreed that a condition existing beforehand of intrinsic delicacy of constitution, call it scrofulous or tuberculous or what you like, is essential to the production of the disease; that it may be precipitated and brought into action by a fall; but that it may arise spontaneously; that it is more likely to arise if the child has a fall than without it; but that the fall is not the one sole cause of the disease. One can hardly look at ordinary strong children in the first period in which they run about, from ten months to three years of age, and see their extraordinary suppleness and activity, and the falls they get, and

the injuries they undergo without any permanent result, without thinking that the mass of mankind, who are healthy, at that age are so built and constructed that ordinary injuries do not produce caries of their spines, or diseases of their hip-joints. On the other hand, in the very delicate child, slight injuries, which are thrown off and shed easily in the healthy one, start up this pre-existing tendency to inflammation of the cartilages between the vertebræ, or in the bone.

That, I believe, is the usual history. Delicacy in the child, a slight injury or none at all, the commencement of disease in the cartilages, and caries of the vertebræ following. Unfortunately, in the early stages, this disease is more likely to be overlooked than hip disease in its early stages. It is only in the very earliest stages of this disease that treatment can arrest the diseased process; and as time goes on treatment becomes more and more hopeless; and when we interfere in the latter stages we should bear in mind that the cure of nature in this disease is also wholly by anchylosis; anchylosis at the expense of deformity; life at the expense of deformity; health at the expense of deformity: and that a case of advanced Pott's disease of the spine which recovers without deformity, and recovers straight and well, must be very rare — I mean without some deformity. Of course, we have all degrees.

The cartilages ulcerate, the vertebræ break down, their bodies drop together and melt away, the spines are thrown backwards out of position, the body becomes bent forwards, and in this false position nature makes a great effort at repair; throws out new bridges of bone; fastens together two adjoining vertebræ; holds the bones in their new position; and finally makes a cure with a stiff joint,

and with deformity. That is the common result if left alone.

The early symptoms of caries of the spine are very insidious. They are so because of the youth and activity of the patients; and also on account of the great natural mobility of the spine, and the fact that pain, or diseased conditions, are disseminated, so to speak, up and down the long column, where one part can compensate, to a considerable degree, for a loss of motion and usefulness in the other part of the spine. This disease comes on generally soon after the child begins to run about and be active; one and a half to two years of age, to three or four years of age, is the common time. It rarely begins after childhood. It may begin in consequence of injury, or in consequence of that active tubercular or scrofulous condition which may be lighted up in the feeble child by the second dentition, at ten to twelve years of age. It rarely begins after puberty. If it does not go through its stages and cure itself before puberty, it never gets well, so far as my experience goes. It usually begins as soon as the child begins to run about and be active, and is overlooked, in this way. The child complains of being tired, and is thought to be merely fretful and capricious, or cross. The child is unwilling to go upstairs; it is unwilling to stoop down and pick up things with any celerity; it complains of constantly having pain in the stomach. This pain is about the præcordia and ensiform cartilage; and is a transmitted pain carried along the nerves between the ribs and to their terminations in the centre of the body in front, and the pain is experienced there, and is really a reflex of a disease of the bodies of the vertebræ and about the intervertebral foramina, from which two or three of these pairs of nerves have made their exit. The abdominal and præcordial pain, pain at the pit of

the stomach, is a spinal pain; has nothing to do with the alimentary canal. The child is tired; unwilling to make exertion; complains of stomach-ache; frequently sits down to rest itself; supports itself on chairs and furniture; seeks a position where it can get its elbows on the table. A peculiar stiffness of the gait becomes developed very early; the child walks with care, instead of running with that perfect abandon seen in young children. It squares its shoulders, differently from the ordinary loose gait of the child; and it has a sort of military look in its whole bearing and gait. The scapular muscles are set. The child walks as if it were made of glass; and this is very characteristic, and unlike any other disease.

A stiff back, square shoulders, dislike to stooping, constantly supporting itself, and after a little while spasm of the legs, legs adducted, and a tottering gait. If this child is examined, you will find, probably, in the dorsal or lumbar region, a projection, a slight knuckle projecting beyond its fellows. This, however, may exist without the other symptoms; and when it exists without the other symptoms, it does not mean anything at all. You may take a healthy child, strip it, and stand it up, and if it is not very strong you will occasionally see one vertebra out beyond the others, and looking as if it must have Pott's disease. You will find on examination that this is a false sign. This false sign is to be diagnosticated in this way. When the projecting knuckle is the result of caries of the vertebræ beginning, it is immovable; can never be thrown out of sight; never be effaced; and always stays, in whatever position the child puts its back. You must take this sign in connection with every other sign; but it is an extremely valuable diagnostic mark. But the weakly child, with a loose, projecting spinous process, retains the supple-

ness of the back, and if pricked or pinched, hollows the back and draws the projecting spinous process in, out of sight.

There is not much pain in the back in caries of the vertebræ. Very little pain is elicited on pressure. Much more pain is elicited on pressure in ordinary sprains of the back, or in an hysterical or nervous condition of the spine, than in Pott's disease. You may press on this vertebra; you cannot elicit pain or displace it. It is held by the muscles, by the ribs, by the locking of bones, in such a way that the pressure has no effect on the diseased point. There are two modes in which you can elicit pain. One is brutal and dangerous; the other is not. You are instructed by some authorities to crush down the spine, and see if the child will cringe. That is dangerous, because it may produce new crushing of the vertebræ already softened. There is another way; you may take the child, that is, lift the child, with the hands around the ribs, about opposite the seat of disease. The heads of these ribs are crowded in against the diseased vertebræ by this effort, and while no harm is done, a scream is almost always elicited; while it does not hurt a healthy child a particle. I do not attach so much importance, however, to these methods, nor do I advise you to pursue them. You can learn much by the general symptoms, and the fact that the projection will not disappear in the case of Pott's disease, and will otherwise. The spasm of the limbs, tottering gait, irritable bladder, wetting the bed at night frequently, constipation, change in the shape of the arch in front, so that the ribs become turned up, and the child becomes pigeon-breasted, the shoulders sinking more and more; the child ceases to grow in size; the head becomes sunken between the shoulders; one knuckle of the vertebræ becomes three, then becomes five, three prominent and two less so, until the marked

and unmistakable hump is apparent in the back. This last sign is much more evident in some parts of the back than in others. In the dorsal region, where the curve is outwards, a prominence will show itself much more quickly than in the lumbar vertebræ, where the curve is inward. The most marked and characteristic of all are the deformities produced in the cervical vertebræ; not only from the sinking in of the head, but by the great spasm of the muscles of the neck; by the peculiar position in which the child constantly carries it-itself, and the deformity. Soon after this, signs of abscess begin to come on, marked by hectic fever and sweats. It is a long while before that abscess shows itself on the surface. It is at a great depth. It is near the centre of the body, in front of the vertebræ. There it seeks an outlet in two ways: either gravitates down and gets into the psoas sheath, and emerges under Poupart's ligament, and makes a psoas abscess; or else pushes directly backwards in the loins, emerges from between or below the ribs, and becomes a lumbar abscess. This abscess is essentially a cold abscess; full of caseous matter, and from broken-down vertebræ. It is extremely slow, a matter of months and years; frequently passes away in the end, after the child recovers by anchylosis, without breaking at all. It is absorbed and inspissated in such a way that the abscess finally disappears. When it does break it is after a long period and by a minute opening, by which nature guards the ingress of air into the sac, and lets the pus trickle from a little valvular hole. The abscess continues to discharge for several years. Meanwhile the deformity of the back goes on to cure; reaches its limit; ceases to press out further; begins to assume a fixed position; grows more and more so from month to month; bony anchylosis takes place; the abscess dries up, and the child has recovered,

at the expense of great deformity of the back; of deformity of the chest; with strong arms and shoulders, but weak and wasted legs.

These patients live to old age. They appear to withstand other diseases with great vigor. When they have Pott's disease, they rarely have anything else. They are well and active. Moreover, in all this peculiar class of cases affecting the spine it is noticeable, I think, that mental vigor is greater than the bodily loss; that these children are distinguished by mental acuteness; like the blind, who, shut off from one sense, develop all the others; so these children, shut off from locomotion and play, and possibly having some sort of diseased condition of the nervous system at one part, seem to develop a certain precocity of mind in the brain; so that wherever you see a humpback child you find a bright one, who knows a great deal, and has learned as much by observation as his fellows learn by education.

What shall be done in the way of treatment? Of course, treatment to do any good must be applied at a very early stage; and here, just as in hip disease, we try to keep the part at rest. The treatment must be mechanical. The child at first must be confined upon its back on a frame, or with double extension, in some way, so that anchylosis may take place; or, if this is impracticable, the child must be allowed to go about with a spinal support, in such a way as to take off the weight of the shoulders and head from the diseased part; to support the spine on the pelvis, and also to hold the parts at rest. The use of the frame on which the child can be strapped and held temporarily is, I think, most useful, because this does not necessarily confine the child to bed. It can be taken up, turned about and kept clean, carried out of doors and kept more or less in the open air; while at the

same time the spine is kept at a perfect state of rest. On the other hand, if this is not practicable, a good spinal support, and allowing the patient to run about, is probably the best mode of treatment. That gives nature a slight chance; and a slight chance usually suffices; and unless an abscess has taken place, a cure usually results by anchylosis.

As to the treatment of these abscesses themselves. Like all cold abscesses, there are four methods of treatment: repeated aspiration; injection of a fluid to promote absorption; incision of the abscess, and fourth, I should say, letting it alone. It may become inspissated. Incise it and you run a great risk of septicæmia unless you can clear out and clean every pocket and scrape the carious bone. Repeated aspirations may be useful, but they inevitably end in a permanent opening through which the needle has been passed, and establishing a sinus, so that you merely anticipate nature a little, and prick an abscess, giving it exit through a valvular hole. These abscesses must be watched. There is no haste about them. They are slow. You can afford to wait. If they are opened, you must wash them out and scrape in so thorough a manner that the development of septic absorption may not take place; and even then death sometimes takes place in forty-eight hours, from the shock of opening a large pus cavity. Apparatus, if applied early, will check the disease and hold the bones so that they will get in good position and unite by anchylosis. The cure, to be perfect, must be before puberty. Abscesses must be opened very slowly indeed. Remember, the best mode of treatment is to have the child secured on a frame or splint, and taken out of doors; kept in warm air; somewhere where it is constantly summer, if possible; or under the influence of sea air, and the best hygienic surroundings. It is extraordinary how

much better these cases do in sea air than in the air of the hot, inland country.

LATERAL CURVATURE OF THE SPINE.

This is very common. It is a distortion, but not a disease. There is no caries, there is no affection of the spinal canal. There is a twisting of the vertebræ in various directions on account of the unequal action of the muscles of the back. In consequence of this twisting and distortion, the ribs and sternum also get drawn out of place. One of the first signs which attracts attention is the fact that the shoulders are not even. You know how common this is in young people and in those who are growing rapidly; one shoulder is a little higher than the other, preferably the left. That is due in young subjects, however, frequently to careless attitudes in sitting and studying and writing, etc. But this comes on insidiously, and at the same time the shoulder is drawn up the hip on the opposite side becomes pushed out, to compensate for it, so that we have a high right shoulder and a prominent left hip, for example. It is especially a disease of females, though not confined to them; probably more in females because they have less active exercise than boys. The curve is double, and when it inclines, for instance, to the right side in the upper portion of the vertebral column, there always is what is called a curve of compensation to the left in the lumbar part of the column, in order to balance the body. These two things always go together. In the early stages the spinal column is flexible and movable, and by throwing the arms and muscles in certain positions the column can usually be restored to shape. As time goes on, if this trouble is not attended to, it begins to distort the cavity of the thorax very much, so that it becomes one-sided,

and the child is also pigeon-breasted, so called, from the projection of the sternum. In a little while the vertebræ begin to be rotated upon themselves, through the action of the displaced and weakened ligaments and muscles, and although they are not drawn apart from each other, and although the spinal canal is never infringed upon in a way to make meningitis, the resulting deformity sometimes is incurable. The vertebræ become so far twisted out of shape that it is impossible to restore them.

The diagnosis and treatment both are most important in the earliest stage; and in that early stage the trouble can generally be corrected by the proper use of the muscles. One very useful exercise, which is very simple, is to have the child drilled to carry light weights upon the head. This may be any form of light weight; but a very good way to teach the child to do it is to place a little mat upon the head and set in it a bowl of water; and the child is instructed to walk backwards and forwards so many times. The slightest deviation will cause the tipping of the bowl and the wetting of the neck, and speedily remind the child to resume the upright position. It is a well-known fact, that among the races of the tropics and some parts of the south of Europe the custom of carrying heavy burdens upon the head leads to an unusually upright and steady form. It is not the custom here in any form of labor; and it is never practised in gymnastic exercises. In addition to this, the child should be watched carefully about sitting, studying and sitting at school; and instructed, if weak, to lie down certain parts of the day in the prone position, on the stomach and chest, and with the arms in such a position as to bring the spine back to its natural curves. These children are weak, and if the spine begins to get out of place, the back muscles grow

weak, and the child droops more and more. The other exercises, which are more important, are gymnastic and calisthenic exercises, which may be done with light weights and wands or dumb-bells and light gymnastic apparatus: rings, pullies, chest weights, etc. Care must be used in these exercises, that the weakened set of muscles are exercised more than those on the well side; and the left-arm exercise for example is especially useful for the child who has a curvature to the right. Take the child and put it in different positions until you find what will best restore the curve, and then outline the exercises. By these, and the use of electricity and rubbing, the recumbent position and the carrying of weights on the head, the early cases can be cured; but when the disease becomes well confirmed and the vertebræ are really twisted out of place, we must try to force them back by the use of apparatus. This is difficult. Apparatus should not be used with the idea of being the only means, or the great means of cure; but only in bad cases, as a support, to prevent the parts from dropping over farther, until the muscles can be restored by proper gymnastic exercises.

The disease leads to terrible deformity if untreated. The child becomes dwarfed because the length of the vertebral column is lost in these curves. And some of the most marked deformities you see on the street are from this cause; at the same time, there is nothing to interfere with the patient's living; and although remaining deformed, they may remain reasonably healthy; but after the vertebræ are thoroughly twisted, and the period of puberty is passed, and the growing age is beginning to diminish, a cure and perfect restoration to the upright form is almost impossible.

XXIV.

DISEASES OF THE NOSE.

Epistaxis. — I will speak at once of the most common affection surgically that we have to treat in the nose, and that is the epistaxis, or nose-bleed. It comes from a variety of causes. In a certain proportion of cases it is wholesome and useful. It depletes very rapidly the venous sinuses at the base of the brain. There is a direct communication with the veins of the nose through the cribriform plate of the ethmoid and with the base of the brain; and in youth, in violent exercises, in persons who are plethoric, etc., moderate nose-bleeds frequently are useful, and if not excessive, need not excite anxiety. In old age, however, in elderly people, nose-bleed, when it amounts to anything, is frequently the sign of some congestion in the head, which should warn us that the patient may be in danger of rupturing a vessel and having apoplexy. Nose-bleeds in old people are rather unfavorable signs as regards the prognosis of future life. Something is apt to take place after this warning is given; and we should be very careful about the diet and exercise of such patients. But nose-bleed only becomes injurious in younger subjects when they either are the subject of some other disease, a diseased condition of the blood or constitutional disease; or else when it becomes very frequently repeated, apparently from the state of anæmia, thinness of the blood and weakness of the walls of the veins. Typhoid fever, diseases which affect the blood, as purpura,

or profound anæmia, are frequently associated with nose-bleed. Occasionally, as you know, it is merely vicarious, so to speak, occurring in the place of habitual discharges in other directions; especially the menstrual flow in the female is sometimes supplemented, or aborted, by the frequent occurrence of nose-bleed. So also, certain patients who have trouble about the rectum and bleed from piles, occasionally have this arrested, and then have epistaxis follow. This is not so severe, and should not be classed with those cases which are what is called true bleeders, where there is that peculiar constitution of the blood that it lacks the fibrinous sticky element, and cannot coagulate when thrown out from the vessels. These patients may bleed from any point: from the gums; mucous surfaces like the urethra, and sometimes from the skin, making a bloody exudation from the true skin. This is associated with a condition of the blood which is usually inherited. Such cases are not very frequent. They can hardly be classed as the ordinary accidents of nose-bleed. Any acute disease of the liver, which is going on to a fatal condition, is frequently followed by hæmorrhage; hæmorrhage by the nose and mouth and bowel is one of the common results. In typhoid fever, where the fever seems to expend itself and its force on the head and nervous system, bleeding from the head and nose seems to take the place of bleeding from Peyer's patches.

Ordinary nose-bleed need occasion no alarm. It is best arrested by keeping the patient in the upright position, applying cold, avoiding stooping over; sometimes it can be arrested by keeping the hands above the head a little while; frequently by the application of cold to the spine, or cold over the forehead, or cold, in the form of pieces of ice held

in the mouth, where it will press against the palate process. These measures are simple ones and are generally sufficient. When they are not sufficient, frequently the putting of a small plug of lint in the nostril which is bleeding, especially if it is dusted over with a little dried persulphate of iron, succeeds. Syringing out the nose with cold water is sometimes effectual. These measures are enough for simple cases; but the cases which excite alarm are those where the bleeding goes on almost without stopping, but with remission, for, perhaps, an entire day. The patient becomes gradually quite feeble and exhausted. The respirations are very much impeded by the enormous clots that form in the nasal passages, and which temporarily arrest the bleeding; but it keeps breaking out. If the patient lies down from faintness, the blood goes on trickling slowly backwards and large quantities of blood run down the pharynx, and are swallowed. Then, after a while, the stomach being distended by clots rejects these; vomiting comes on and that starts the nose-bleed again. So in one of these bad cases, I suppose, if they went far enough, a fatal result might ensue; though usually they are stopped before that result is reached.

Simple measures are of no use in these forms; and the most thorough way to arrest the bleeding is by plugging the nose, the anterior and posterior nares as well. Each nostril is a separate cavity. It is rarely that bleeding occurs from more than one nostril at a time; and the bleeding nostril is plugged front and behind, and the plugs left in thirty-six to forty-eight hours. Some surgeons advise leaving them three or four days. The objection is that they soon become very foul and offensive, and provoke ulceration of the membrane covering the delicate bones inside the nose; and may, if kept in

long enough, lead to caries of the bone, and a chronic state of ozæna with filthy discharge. It is always a delicate matter to decide the time when the plug shall be taken out in a bad case; but, as a rule, by forty-eight hours an attempt must be made to remove it carefully; and if bleeding occurs, a fresh plug may be put in, which is clean and aseptic, and may be left in considerably longer. It is perfectly easy to plug the anterior nares. To get a plug behind in the posterior nares is impossible without a guide. That guide must be a thread passed through the nostril, behind the soft palate, out of the mouth. The patient must open his mouth wide, a gag is put between the teeth, and the thread is carried through by a little instrument called Belocq's sound. The sound is threaded, passed through the nose, and the finger passed into the mouth catches the thread and draws it out, and the catheter is withdrawn; the other end is out of the nose. We have the location we wish to plug under control with this string. To the end which comes out of the mouth must be fastened another double thread, and to this a small piece of lint or sponge, not too large. If a sponge, it will swell to a certain degree; but the lint will not swell. That must be tied with a double thread, and then passed into the mouth, and guided with the finger behind the palate, and pulled firmly into the posterior nares, so that it will not drop back into the throat. Another plug is put in front, and a string tied over it, so that the two are pulled together. The cavity between is gradually filled by coagula, and bleeding is necessarily arrested. The use of the two strings on the back, where the plug is attached, is to leave one coming out of the mouth, which can be fastened around the ear, and which is a guide to the posterior plug. This is important, because in removing the posterior plug we wish to do it with as little excitement as

possible, and if we have no guide, we are forced to take a catheter, or something of that kind, and put it in the nose and dislodge the plug, and catch it as it drops in the throat; whereas if we have a string guide, we cut the anterior string, take out the anterior plug, and pull on the string in the back of the mouth, and easily withdraw the plug. This may make the difference between starting the bleeding and having to plug over again. To our surprise we see how much suffering is produced by this plugging in the first twenty-four hours. At first the patient is relieved of bleeding, and he can take nourishment and lie down and sleep; but he soon has pain in the nose and face and eyelids. All the parts about the cheek begin to have an œdematous swelling to a very marked degree; and the skin of the nose is largely distended by swelling, and the patient looks as if he had an attack of facial erysipelas coming on. This is due to the pressure of the plugs; and if they are left in too long, it may be followed by septic consequences and dangerous results. On taking out the plugs, the swelling slowly subsides, and the case is over.

A little rubber arrangement, which is very like what we call the colpeurynter used to dilate the cervical outlet, can be used. That can be flattened out and with a probe or director passed in until it projects into the posterior nares in the throat. When it has got fairly through the nostril, it can be blown up with air firmly, and it makes a sufficient air plug to the passage. Of course, it adapts itself perfectly to the shape of the nasal cavity, and makes a very ingenious and neat plug. When we have one of these it is easier to use and to remove than the more clumsy method of the sponge. In many cases we shall be called to a distance, to a case of nose-bleed, without these preparations, and we need not wait

for Belocq's instrument, but with a good strong elastic catheter we can accomplish in a few moments the arrest of the hæmorrhage.

Deviations of the Septum of the Nose. — The septum is partly bony and partly cartilaginous. The cartilaginous part is thin and elastic, and covered with delicate mucous membrane and vessels and nerves. This frequently grows out of place, sometimes probably in consequence of a blow, and sometimes by a spontaneous deformity which pushes it to one side and gradually occludes one nostril. This condition leads to catarrh, retention of secretions on the side where the occlusion is, to change of the voice. When the disease goes on a little longer, and is not treated, changes take place in the septum itself; and as the young person grows older the septum thickens and grows out bony ridges and spurs which project on the occluded side and still more obstruct the nose. The septum can be broken and forced back into place in the early stages of the affection. It will not, however, stay there, but recoils just like a piece of birch bark. It can only be forced to stay back by cutting through it, and destroying its elasticity. In more severe cases it is often best to saw off a piece of the septum with a fine saw on the occluded side. The spurs are sawed off, and a pieee of the septum sawed off. We may or may not go through. Sometimes we can succeed in sawing off the spurs without sawing through into the other side of the nose, sometimes not. If we saw through, a small permanent opening is left. If it is too small, it is sometimes accompanied by a whistling sound in breathing, which is annoying. If it is opened, it is better to make it of sufficient size, that the air may travel back and forth without making this sound.

The septum is the seat of ulcerations which used to be

thought to be syphilitic. They frequently are tuberculous. The ulceration may go so far as to perforate the septum, and the patient has an opening through the septum which is frequently the size of a dime or lead pencil. It does not make any external deformity whatever. It does not make the nose of that peculiar shape that it does in syphilis, when the vomer is cast off by caries. There is an obstinate ulcer, with a little hole leading through. Local applications of various kinds, and constitutional treatment, are the best things that can be done. Usually granulations can be encouraged; and if the septum is not eaten through, the ulcer can be healed. If it is, the hole can be healed around the margin so that it will not expand, and the patient get along very comfortably. It is important to recognize the fact that many of these ulcerations are in perfectly innocent parties with regard to either primary or inherited syphilis; and that they are quite common in young and scrofulous subjects.

The cartilage will not stand any very violent applications. If you try to cauterize it, anything of that kind, you make the cartilage ulcerate and break down more. Cleanliness and mild antiseptics and constitutional treatment should be employed.

The turbinate bones grow out of place, grow exostoses, project into the passage and frequently obstruct the breathing. Portions are frequently cut away with benefit, and sometimes the trephine is used and the turbinate bones cut through, giving the patient much deeper breathing power. Since the use of the electric light and the rhinoscope to look into the nose, and the minute electric wire which can be heated as a cautery, it is easy to burn off portions of the delicate bones of the nose with safety and without much suffering. Ether is not necessary. In fact, that is not desirable

where the hot wire is used, because we are in danger of setting the ether on fire. Cocaine is all that is necessary to blunt the sensibility enough to do this sort of operation.

Foreign Bodies in the Nose. — In a child with trouble in the nose your first thought should be, is there any possible foreign body concealed in the nose? Infants and children are very apt to put substances up in the nose, and those are generally of a character that cannot be got out easily; beans and peas and buttons are favorite objects. They are pushed up far enough to get beyond the inferior turbinate bone, and are there held; provoke constant discharge, and other signs of chronic ozæna, or polypus. The child is frequently brought to the doctor with the idea that it has polypus. Careful search will find something hard in the nose; and the nose sprayed with cocaine and made non-sensitive, the foreign body can be got out, and the case is speedily cured.

Polypi in the Nose.—Polypi in the nose are of two forms. The common form is a soft, gelatinous polypus which grows from the turbinate bones, and sometimes in extreme cases extends its growth up in little colonies of polypi which grow as high as the upper turbinate bone and even as high as the ethmoid. The ordinary soft polyp is attached to the inferior turbinate bone, floats or hangs in the nasal cavity, rises up and down with the movements of respiration. If the patient makes a forced expiration through the nose with the mouth shut the polypus can generally be brought into sight, and is seen lying as a white, soft, gelatinous-looking mass a little ways up the nasal cavity. Or when the patient inspires violently, it is drawn behind the turbinate bone and sometimes when it is large passes back of the posterior nares and hangs back into the throat. In extreme cases they protrude down the throat, and if the patient has the mouth held widely open

and raises the palate by saying the word "ah" the polypus can be seen projecting in the throat behind the palatine arch.

The mucous polypus can be readily removed; but unfortunately this frequently does not permanently cure the affection. The tendency having been developed to their growth, others form. They are slow to form. They frequently do not show signs of returning for six months, but they are apt to come back. The neatest way to remove them is to locate them exactly by the aid of the mirror and remove by the snare or hot wire. If we have not this means, we can follow up the polyp and get hold of the stem and twist it off. It frequently brings away a little of the turbinate bone with it. This does no harm; and by removing the periosteum and root on which the polyp grows, that particular polyp is exterminated, and has no chance of starting again. We must not be satisfied with one search; but put the forceps throughout the nose, and frequently we succeed in extracting one large one, and two or three small ones. After a few days, when bleeding has subsided and the soreness gone, the nose can again be treated with cocaine, and investigated carefully with the lamp and mirror, to see if any others are left.

The signs of polyp are usually those of chronic catarrh and obstruction. They change in their shape and size; swell up with fluids and collapse again according to different states of the system; and where the patient has a slight cold and congestion, it increases the flow of blood to the mucous membranes and distends the polyp. A chronic catarrh; running from the nose; accumulation of secretion; difficulty of breathing; snoring in the sleep, are signs of polypus. When enlarged they distend the nose, but must be of considerable size to do so.

On examination, the two sides of the nose do not corre-

spond. In extreme cases the nasal bone becomes displaced to some degree as well as the cartilage, so that the nose is entirely flattened out on that side. Those are unusual cases.

Ordinary soft, gelatinous, nasal polypi then are usually removed by one of these methods. Subsequently the nasal cavity must be treated by injections of weak carbolic acid and by astringents. Quinine sometimes is very useful; and various agents to endeavor to prevent the return. The milder forms of spray are the best to use in this cavity. The nasal douche, which is merely a repetition of the fountain syringe, is no longer thought to be as desirable as it used to be. It is too violent, too forcible, has occasionally made trouble by distending the Eustachian tubes, and has brought on affections in the middle-ear by being too forcibly used. It is only in extreme cases of filthy ozæna, and where other measures will do no good at all, that the nasal douche is to be used. It is better to use the applications in the form of spray, applied both behind by the throat, and forward through the nose.

The person who has once had a mucous polypus must be on the lookout for others; and when the slightest signs present themselves, he should be inspected and the growths taken out, if possible. With the cautery the bases from which they grow can be thoroughly destroyed; and, sometimes, after one or two operations, no more recur. Sometimes they recur after long intervals.

The other form is essentially a fibrous tumor, and is called sometimes the naso-pharyngeal polypus because it affects the posterior nares and the top of the pharynx. It grows sometimes from the edges around the nasal cavity, the little hollow of the pterygoid process; and sometimes about the posterior septum of the nose; and frequently, also, from what is

called the occipito-sphenoid bone, the junction of the sphenoid and occipital at the true base of the skull. This, of course, is at the very top of the pharynx, and covered with mucous membrane; it is in a pouch at the top of the pharynx, and the fibrous tumor, we call the naso-pharyngeal polypus, frequently has its growth there. It obstructs the posterior nares; and in bad cases, can be seen from the mouth. It is not of uniform size; is generally pear-shaped, and has a stem and a large body. Occasionally the growths are broad and cover the whole of the occipito-sphenoid bone.

These growths most often occur in young subjects, during the period of about fifteen or sixteen to twenty-four or twenty-five years of age. They grow very slowly, and the patient first suspecting that he has chronic catarrh, finally becomes aware of something which obstructs the breathing. The surgeon, if he fails to see anything in ordinary inspection of the throat, can detect the trouble usually by passing a silver catheter, or elastic catheter on a wire, carefully curved, gently through the nares down into the throat on one side; it will soon be found that the catheter strikes a prominent obstruction on one side, or the other, and the location of the trouble can be made out. With the electric lamp in the throat and the rhinoscope, the tumor can be seen back of the palate. If we have not this means, we can diagnosticate by means of the finger. The patient's mouth wide open and the finger passed in, up behind the soft palate; with this we can explore both of the posterior nares. It is a disagreeable experience for the patient, but does not produce any harm, and only the sensation of momentarily choking, and perhaps a little bleeding. In that way we can locate the growth; determine its size; shape; attachment; and see on which side of the posterior nares and pharynx it lies.

Being there and increasing, it may go on to cause a fatal result; leading to trouble at the base of the brain; to destructive changes in the pharynx; finally hanging down as low as the epiglottis and back into the œsophagus, in marked cases; and obstructing swallowing, and endangering the patient from chocking while breathing or swallowing. It is then evident that it is very important, as soon as the diagnosis is made, that this growth should be removed; and a great many ingenious modes have been used to do it. The simplest form is to attempt to snare it by the snare passed through the nares, or else up behind the soft palate. If a lucky case with good pedicle, this may sometimes be done. Nélaton found that the soft palate presented a barrier to the last one-half inch, which was in the way of getting the snare around. He devised the operation of splitting the soft palate, and passing a thread through either tip of the uvula; drawing it aside, and fastening it outside the mouth; and then you gain one-half inch or more of space by which you can get access to the posterior pharyngeal region. Then the polypus was removed by snare or forceps; and the soft palate was sewed up again.

It has been found, however, that most of the operations of this class, which merely snare off the polyp, do not prevent its subsequent re-formation; and that it is essential that the base should be reached and scraped away, and the periosteal layer under the mucous membrane be scraped away, in order to insure against the recurrence; so that in order to get at this space other operations were devised. One was to cut a piece of bone out from the speno-maxillary fossa, turn the bone back, and expose the whole nasal cavity; this was Langenbeck's method.

Another was to saw across the top of the antrum, beneath the zygoma; split the palate process, after extracting one incisor tooth; depress and break down one superior maxillary bone; leaving it hinged on the pterygoid process; then pass the finger through this gap, push the septum to one side, and get ready access to the point you wish. That is the operation that I have done a number of times.

Whatever operation of this kind is done, after the polyp is scraped away and removed, the jaw is pushed back to place and wired, and the wound closes, and the bone unites, as a broken jaw does, and gives no subsequent trouble.

When it is borne in mind that before these operations were devised the only other alternative to destroy these large fibrous tumors was to excise the upper jaw, you see how much we have gained in the point of conservative surgery.

The prettiest operation of all was devised by M. Olliėr of Lyons. You would not suppose at first it would give the needed room, but it does. It consists in sawing down and depressing the nose. You make a cut from the centre of the forehead, down each side of the nose, to the point where the artery goes to the ala. Cut through the periosteum to the bone on each side. Having made that cut, you take a moderately narrow and quite flexible saw, lay it as flat as possible on the forehead, and saw down through the nasal bone, down to the cartilage; upset the nose and drop it down on the lips. The nasal cavity is fully exposed. The vomer and septum are in the way. They are flexible and can be pressed over; and you have the means of reaching to the growth of the polyp, which the finger will exactly do; and thus you can extract large polypi by forceps, or by scissors, or by seizing them and tearing them out; and subsequently you go in and scrape this cavity. In these cases it is well

always to operate in the upright position; and when any sign of choking comes on, bring the patient's mouth well forward and drop the jaw until they expectorate. Half etherization is the best. Thorough etherization during the incision through the skin and sawing the bone; the patient partially awake through the remaining stages. Although they make a noise, they remember nothing which has occurred; and it is much safer to have the patient sufficiently awake to retain a little control over the epiglottis. Subsequently to this the nose is replaced. Two fine wire sutures are passed through the lower angle of the nasal bone, which hold the bone perfectly in place. These are brought out through the wound, and the wound nicely stitched. The wires must be left in two or three weeks; two weeks in the nose, and three in the jaw. The wires loosen and ulcerate; the bone decays a little around the holes, and, afterwards, untwisting them, they are drawn out with ease, and the sinus closes. Very little scar is left by this operation on the nose. There need be no fear that there will not be union. All the parts about the upper jaw and nose are so thoroughly supplied with vessels that they repair very great injuries, and always unite.

Malignant Forms of Growth in the Nose. — These are sometimes mistaken for the ordinary polypus. Soft cancerous growths occur on the mucous membrane of the septum low down, just inside the nasal cavity. The parts become obstructed and the patient thinks he has a polypus. On lifting the ala and looking at this growth, you find it is red and very vascular, with little tuberosities on it shaped like a strawberry, or raspberry. It bleeds on the slightest touch; occurs almost always in people of middle age; and it is essentially a soft and rapid growth of epithelioma.

This must be thoroughly removed. Usually it can be done by a very slight operation, by cutting around the ala and turning it up and then the septum and the growth may be cut away, the ala replaced and the only subsequent deformity is the little scar on the side of the ala. If that is not sufficient, excision of the structures inside, with portions of the jaw, must be done. It is not very common. I will call attention to the fact that polypus growing low down, in the elderly person, probably means cancerous growth. True polypi are never, I think, attached to the septum, but always to the turbinate bones. These malignant growths frequently start from the septum itself.

Abscess of the Septum.—Abscess of the septum is a very painful affection. You are familiar no doubt with what is called the little boil that forms within the tip of the nose. It is extremely painful, lasts five or six days, finally breaks and discharges inside the nose. It leaves no subsequent trouble.

There is another form which is more severe: abscess of the septum. It produces a curious deformity. It fills up the nostril completely, so that in seeing this patient first you would suppose the whole nose was filled with an enormous, red, malignant growth; but you find the duration of the disease is not more than a week, or ten days. The nose begins to swell; pain occurs; and this rapid ballooning out of the mucous membrane comes on, and the nostril is occluded. You find it is elastic to the touch.

The treatment is to make free incision and let out the pus, which is followed by speedy cure.

Making of a New Nose.—Artificial noses of *papier-maché*, nicely colored and of a pattern to suit the taste of the wearer, are much better than any artificial nose made from the skin.

XXV.

SURGICAL AFFECTIONS OF THE LIP.

There are three forms of swelling inside of the lip and cheek that look very much alike at first glance. The mucous membrane is raised. The swellings are sometimes spherical. They fluctuate; and they are more or less transparent. On incision of them, however, it will be found that one gives exit only to a clear mucus; another to a pretty solid though transparent jelly; while the third can be squeezed out of sight into the tissues.

The mucous sac, or swelling, is simply a mucous cyst; a mucous follicle. It is very common; comes about the lips; is apparently what is called a retention cyst, from the shutting up of some duct; or, perhaps, provoked sometimes by slight friction of the teeth. It annoys the patient, grows large, projects inside of the mouth, rubs against the teeth, bursts, discharges, heals, fills up again and so goes on until it is excised. It is as innocent as a wen, and to be treated in the same way, by dissecting out the sac. It is a very simple matter; and can be done with cocaine, and without anæsthetics.

The cyst which contains jelly is a myxoma and is a semi-malignant tumor; that is, a recurrent tumor; locally malignant. It is not liable to go to other parts of the body, but it keeps reappearing in the same place. It can be turned out in the form of soft, smooth, gelatinous masses, which, under the microscope, will be found to be tied together by very

minute striæ of areolar tissue. It forms pockets in the cheek and can be turned out in large masses, the contents being like sago.

Incision inside the mouth is preferable if possible, to avoid a scar. Thorough excision is followed by exemption for some time. Recurrence is apt to take place within a year, or more.

The other form inside the cheek, which can be pressed out of sight, is vascular. We have spoken of it under the name of venous angioma; a large mass of veins, which can be pressed out of sight by the thumb; will speedily fill up again; and is curable by the ligature.

Two affections come on the lip which are very different; both dangerous, and sometimes mistaken the one for the other. I will describe them first, and name them afterwards. Perhaps that is the better way. The first of these affections comes as an induration on the upper lip, usually near the angle of the nose, often concealed at first by the hair of the moustache. It is very tender and thickened and painful, and very soon after the swelling begins the patient has a chill and feels sick, frequently has nausea and headache and generally rise of temperature. If now the spot is examined, it will be found to be red, raised and hard, and to be dimpled over with minute orifices; and as it extends further, this arrangement of minute holes, each of them exuding a little yellow matter, becomes larger and larger, until the lip is rapidly involved. The ala of the nose swells up; œdema of the eyelid takes place. Successive chills come on; delirium follows; and death, frequently, in about a week. This is carbuncle of the lip. Not always fatal; but frequently so; and requiring the most rapid treatment.

The other affection, which is extremely rare in this

climate, common in hot climates, in the tropics, ascribed sometimes to the bite of an insect and sometimes to the transmission of some germ through the hair follicle in the skin from decayed substances, is characterized entirely by blackness, hence its French name, charbon. It is on the surface, begins on the outside; carbuncle begins from within and goes outwards through the cellular tissue out to the skin. Malignant pustule, of which we now speak, begins on the surface, and extends inwards; at first, a vesicle, it discharges serum; and after that it goes on as a dry gangrene; a dry slough; first destroying the epidermis, then the true skin, and then the parts beneath; but never very deep; spreading as a black peculiar patch upon the surface, and extending with rapidity, so that if the patient live long enough it may extend a large distance. One case I saw, where the patient had lived a week, it had gone from the neck over the clavicle and half way down the sternum; one large, offensive, black slough.

This malignant pustule, or charbon, is characterized from the beginning by the most profound constitutional symptoms. Generally the patients die within a day or two. The chill is marked; pain intense, fever comes on soon, and very speedily absorption by the lungs; so that the patient begins to have trouble in the throat, thence in the air passages, and thence a species of low pneumonia in the lungs, all caused by the rapid progress of the parasite of this disease, which is a peculiar germ, and which travels and invades the tissues by absorption rapidly.

This malignant pustule is very fatal. Recoveries are very rare. Almost all the victims die, and die in spite of any treatment that has been applied to them. In hot climates it is a common disease; in this climate a rare one. Here it

occasionally finds a victim in some young and tolerably healthy person; and at first, the disease being unusual, as a rule it is not recognized; and in a day or two it has extended so far that it is not only easily recognized, but has invaded the deeper tissues and produced cerebral and pulmonary symptoms.

There is a form of gangrenous disease occurring commonly in this city, and in all cities, in young babies. It is a similar form of sloughing and is called cancrum oris; it occurs in poorly nourished babies, and in babies who are either not born at full term, or inherit poor constitutions, or some constitutional taint. This form of sloughing begins sometimes at the base of the tongue, in which case it speedily separates the tongue from the floor of the mouth, eats through the muscles out through the chin and makes a large opening through and through, in the course of two or three days. In other cases it goes equally fast through the cheek, and as you will see in the pictures in some of the Surgeries, occasions destruction of all the buccal region, uncovering to the air both layers of the teeth on the upper and lower jaw; and if the patient survives, it heals up only on the edges, and an immense open wound is the result, which afterwards, if the child grows up, may possibly be closed by a plastic operation.

This is a true dry gangrene. It is due to imperfect nutrition, and probably to minute embolism of the parts. It is probably not parasitic. It is, however, in appearance very like the malignant pustule, which is purely the result of an infectious germ getting into the tissues. The cancrum oris occurring in these feeble little subjects is best treated by immediate stimulation and food, and the administration of opium; and by applying the actual cautery in the form of the galvanic loop all around the edges, and seeking to

stimulate new growth of tissue, and arrest the dying process. If the child bears this, it occasionally recovers.

Malignant pustule, or the true charbon, if recognized early, should be treated by the most free and liberal excision, out to the edges of the trouble; and then should be dressed with antiseptic fomentations and poultices, and the patient stimulated to the last degree by as large quantities of alchohol as he can tolerate, quinine, food, etc., and opium to allay the pain.

Carbuncle of the lip is very common, and fortunately more amenable to treatment. The trouble with carbuncle of the lip is that it often is not recognized and proper treatment not given to it. Carbuncle occurs in other parts of the body, where its favorite site is the back of the neck or between the shoulders; these locations are a conspicuous aid in the diagnosis. They cause so much lameness in moving about that the patient's attention is soon called to them; and they are diagnosticated, as a rule, very soon after they begin to appear. The only doubt in the early stages is as to whether the disease which is appearing is about to be a boil or a carbuncle. Carbuncle is often mistaken for a boil in its early stages; but speedily numerous openings appear, and it spreads, and is easily recognized. Carbuncle of the lip being hid away and small is apt to be unnoticed. A very painful thickening on the upper lip, with symptoms of extreme sickness in disproportion, so to speak, to the apparent size of the sore, should make us suspicious of what is going on; and all treatment to be of avail must be early treatment, and very thorough.

The deepest and most free incisions are the best treatment, unquestionably, in this form of carbuncle. However surgeons may differ as to the treatment of the other forms of

carbuncle, which occasionally are allowed to slough out of themselves, I think that all agree that in carbuncle of the lip safety consists in letting out all the sloughs and washing out the cavity; cleaning it out as rapidly as possible, in order to prevent infection of the system. To many persons it is of little consequence whether they have a bad scar across the lip or not. Others may be sensitive about it. We can usually get at the disease and do quite well by cutting through the edge, or junction of the mucous membrane and the skin, and splitting the lip open, up into the disease. We can afterwards close this cut, without appreciable scar. But no consideration of looks should have any weight if we consider it necessary to make external incisions to get at the trouble. The sloughs should be thoroughly cut open and freed; the parts washed with antiseptics, and dressed; and the patient's health sustained and kept up by large doses of muriate of iron, given in doses of as much as twenty drops every two hours, well diluted. The bowels should be moved by calomel; stimulants and opiates used freely. Local applications have no effect so far as I know in checking this form of trouble; and it is difficult to apply any very severe or poisonous form of local application so near the orifice of the mouth without dangerous absorption; consequently we must rely wholly on deep and free incisions, cleaning out the parts, dressing them antiseptically and keeping them clean. The charcoal poultice is an excellent one for this form of trouble; made by stirring up a spoonful of powdered charcoal with two spoonfuls of flaxseed meal, wetting with boiling water, and applying. This is comfortable, and destroys all gases and offensive effluvia, and is, to a certain degree, antiseptic.

The danger of carbuncle of the lip is this, that, owing to

the large venous junctions which occur about the face, speedy absorption by means of the veins takes place up to the head, and through the ethmoid plates and the cribriform plate to the brain; and what is called a metastasis; a change from one part to another; but what is, in fact, the travelling of the disease steadily along, not by a jump, but by a steady walk along this road of veins and lymphatics to the brain; and then we have the rapid form of erysipelatous meningitis coming on, which is fatal, usually, in two or three days. Many persons with carbuncle of the lip die; some escape by prompt treatment.

So far then these external diseases on the lip, which come on with chill and severe constitutional symptoms and with rapidity, are of an extremely dangerous type; and should be carefully watched and promptly treated. Now, on the other hand, every once in a while there will come a patient almost frightened to death with a lip as large as the largest African's, stating that he came down town in the morning well, and came back with this. His pulse and temperature are normal; no chill; absolutely no constitutional symptoms whatever; but an enormously swollen lip, coming on rapidly, almost as rapidly as the asparagus or mushroom grows; without a blow; without discoloration; without pain. Only the size alarms him. It is harmless; very peculiar; but does not require active treatment; it subsides of itself in three or four days. It is not fully understood; it never seems to lead to anything else. It goes under the name of rapid, or transient œdema of the lip; but precisely what takes place we do not know. It is a dropsy of the part; a very distensible part. Of course, it is absolutely essential to quiet the patient's mind; not only reassure him by telling him you know exactly what is the matter and that he will

get well; but you must also make some harmless application to the part, and give it treatment, in order to keep him easy. A two-per-cent. solution of boracic acid; flexible collodion painted on, or any simple application of that kind, is sufficient. Meanwhile it is perhaps well to keep the patient at home quiet a day or two; give a simple saline cathartic, and diet him, and the œdema will rapidly disappear.

So much for acute affections; two of which are extremely dangerous, and one harmless; the latter looks worse than all the others, the first hour or two. Of the chronic affections some are very puzzling. A sore upon the lip, what may it mean? A sore which will not heal; of duration exceeding a number of weeks; if exceeding months it is pretty sure to be cancer; if exceeding some weeks, may be a chancre. You can hardly conceive of a chancre of the lips going on for months without producing so marked constitutional symptoms that the diagnosis would be easy; and you can hardly conclude that a sore of the lip which will not heal after various methods of treatment is necessarily cancer, until it has existed several months, and resisted treatment for that time.

Chancre of the lip is apt to be confined to one or the other angle. Cancer is not so frequently found there. Cancer is usually found upon the lower lip; rarely on the upper. Chancre may be on either, but is generally in the commissure and involves both. In both of these affections, you must not be deceived by the inflammation of the lymphatics below the jaw. Cancer has inflamed lymphatics, which are poisoned buboes, from the extension of the germ of the disease. Chancre has rapid inflammation of the lymphatics, and a bubo which is due to the entrance of venereal poison; so that in that point of view your diagnosis is entirely uncertain. A chronic sore which will not heal; both have

enlarged glands; submaxillary and sometimes lymphatic. Neither are painful at all. It is only the looks and annoyance that trouble the patient. Cancer is not painful; chancre is not painful. In fact, they are rather free from sensitiveness. The hard Hunterian chancre, if it occurs on the lip, has the same indurated edges as the cancer; and the same excavated and hollowed out and indolent base; so therefore we have got to consider all the pros and cons; and probably it is not of much use to ask questions in such a case as this, but we have got to judge for ourselves; and if we find a disease of several weeks' duration, my own rule would be to put the patient on mercurial treatment and see what it will do; and either it will have no effect in a fortnight, or a cure will result in a fortnight. The moment the system becomes affected by large doses of calomel, kept in the system by opium, you will have a melting-down of the sore if venereal, and the glands in the neck will disappear. Not the slightest effect will be produced by such medication on true malignant disease; and if you have pushed the thing so far that you have mecurialized the patient to a slight degree, so that his teeth begin to be a little tender, breath a little odorous, the mouth moist, stop and give up that theory at once. If you could know the beginning, which you sometimes cannot, if you could know the first symptoms which appeared, I think you would have no difficulty in distinguishing between chancre and cancer on the lips.

Cancer of the lip is an epithelioma. It begins on the surface. It is a proliferation and throwing off, and finally a hardening of the epithelial layer. At first the patient notices a spot on the lip, which is dry and tense and cracked. Then he finds every little while that he is moistening it, or rubbing it, and bringing away a few epithelial scales. After a little

while a slight scab forms. This is perhaps let alone a few weeks, finally detaches itself, and he sees underneath a shining smooth surface, and thinks this surface is healthy. The part looks as if it was going to recover its natural appearance. In a few days more epithelial cells form, and another dry layer forms, and so the disease goes on, week after week, and month after month, until he notices around the line of cells an induration, a hard collar. Subsequently to this an ulcer forms; and this ulcer is in the centre of the hardness and where the first scab appeared. By and by a second scab comes off, and he finds again the ulcer. Once established to that degree, erosion and extension of the disease begin.

If we could see the very beginning, we should find that chancre of the lip begins three or four days after exposure by a pustule and a little discharge of fluid, which ruptured and made at once a sore, whose edges subsequently became indurated, and went through the stages of chancre.

Provided the mercurial treatment is of no avail, and provided we are finally convinced that we have to deal with a sore of the lip which is probably malignant, and which will not heal within a short time, the best way is to excise it, and widely, so as to leave a good margin of sound tissue round about; and if any glands are present they must be removed at the same time. The chances of recurrence are great, but not certain. Epithelial disease of the lip is occasionally cured permanently. Frequently it is not. The period of recurrence is much more uncertain than in cancer of the breast, for instance. It may be several years. It may, on the other hand, be extremely rapid; and that is liable to be the case in young and vascular subjects. It is a noticeable fact that in the young, strong, and well-nourished subject, who is full of blood, diseases grow with more rapidity, as healthy tissue

grows with more rapidity; and in the feeble, anæmic and dried-up persons of middle age, the forms of malignant disease share in the general want of vigor of the economy and grow slowly, and slowly destroy life; so in these young florid subjects, in whom an epithelial cancer appears on the lip and is cut out, I have seen recurrence in the glands of the neck within three months; seen several operations done within a few months, and life terminated within a year from the first appearance of the disease. In this respect, in some subjects, the cancer of the lip resembles in its rapidity and its fatality the effects of cancer upon the glans penis or the foreskin, where the lymphatics on the dorsum of the penis become promptly affected, the glands in the groin take up the disease, the lumbar glands inside the pelvis become affected, and death within six months, or a year, is the common rule. However, we may feel sure that if we can make the diagnosis, and the earlier the better for the patient, and excise the epithelial cancer of the lip, we can promise the patient a considerable period of exemption, as a rule; and a chance of its not coming back.

The only other means of treatment that would seem to be effectual would be the hot iron, or caustic; and experience has proved that they are no more sure to prevent recurrence; that they are more destructive and disagreeable in the wound they leave; and make a much worse looking scar.

About the upper lip again, and around the ala of the nose, is a very common site for tubercular disease, sometimes called lupus. There used to be distinguished two forms of lupus; one said to be much less destructive than the other: one called lupus non exedens and the other lupus exedens. One did not penetrate deeply into the tissues, and was localized, and not eating or destructive; and the other destructive.

We now distinguish one as simple lupus tuberculosis; and the other, rodent ulcer; and the rodent ulcer belongs rather with cancer. But the simple tuberculous lupus which appears about the nose and upper lip, is a slow, chronic affection, free from pain, looking at first like a set of little boils coming upon the part, each one breaking down and discharging separately, slowly, and each healing up by a little white puckered scar; and another set forming by the side, and the other set forming by the side, and the process going on in little successive crops; so that, finally, the ala of the nose and the upper lip become wrinkled and shrunken by these numerous little white scars. Meanwhile the disease is creeping over the skin, and every little while fresh tubercular points appear. These tubercles are hard, appear like nodules, you might think they were of the same feeling and appearance as carbuncle, but they lack wholly the constitutional symptoms and the rapid progress; and also they are to be diagnosticated by the fact that you almost always see them at that stage when some have existed and gone through their lives and ended, and others are beginning; so that if you look carefully, you will almost always find about the tubercles of lupus some scars which indicate where other tubercles have been. No such condition is found around the carbuncle, whose progress is rapid, whose destruction is complete of all the parts round about, and which, when it does cicatrize, cicatrizes finally, at the same time, in one large puckered and indented scar, but never has separate points of healing.

The rodent ulcer, on the other hand, is a clean-cut, excavated, partially-granulating, red hole, eating into the parts slowly; filling up and eating; filling up and eating, undermining the skin as it goes on. Its progress covers years. Patients live with it ten or fifteen years, sometimes. It is

almost always a disease of more than three or four years. It is painful chiefly by exposure to changes of temperature; but it is also subject to stinging pains which are quite distressing to the patient. It progresses steadily, slowly, does not heal. It first destroys the skin and soft parts, then cartilages and bone; and eventually eats away the jaw, perhaps, and side of the cheek; invades the orbit, destroys the eye; and at the last stage passes through and destroys the thin bones which roof the orbit, and attacking the brain speedily closes life; but life usually lasts after the extinction of sight for months, and years, perhaps.

Lupus is treated, as you know, by the injection of Koch's lymph. It is also treated locally by burning it, burning out out each separate sore. That seems to be pretty effectual. Sometimes the pencil of nitrate of silver does pretty well, sometimes the hot wire. We should persevere and endeavor to break up the local points. The rodent ulcer, if one can be found where the disease is small, should be treated by immediate and large excision of the ulcer and all parts about for the width of one-half inch; and then we endeavor to do a plastic operation, and heal up the parts. Seen at a later stage, we are obliged to resort to the use of the cautery, which is about as good as anything; and the local application of means to allay the pain. The most comfortable application and cleanly, I know of, is a soda and opium wash, made of one part of laudanum and two of liquor sodæ chlorinatæ and ten of distilled water. It is an incompatible mixture; but it is very effectual. The morphia is precipitated and falls to the bottom, but is there in the form of morphia. If shaken up, it seems to be equally effectual in quieting the pain.

Salivary Fistula. — Salivary fistula is not a very common

thing. It is frequently caused by alveolar abscess, which eating through the cheek has involved Stenon's duct and led to an ulceration out through the cheek, letting the saliva flow outwards instead of in. Salivary fistula is also occasionally caused by the surgeon in operations. It is not always possible to avoid the duct in operations. Sometimes the duct is left cut off in such a way that it subsequently discharges from the wound, and the wound refuses to close. This condition of things is sometimes very curious. It closes in a measure, and there is a valvular covering of the little affair, which in the ordinary state of the parts keeps that perfectly dry. The moment the person begins to take food the salivary secretion is excited, and as soon as he begins to chew and masticate the saliva begins to flow, drop after drop, rapidly from this little fistulous opening. The meal over, the saliva ceases to flow until he again eats. This is an incurable affection, unless you can find some means of directing the flow again into the mouth. This is best done by establishing a new false passage into the mouth; then afterwards doing a plastic operation to close up the wound; and thus the salivary current can be again turned into the mouth. This is worth thinking about, because it is apt to be overlooked; and the patient having had an abscess, or ulceration, or operation, tells you he has a spot on his cheek which is constantly becoming wet every time he eats; and on careful search you find a little pimple there, out of which a drop or two of saliva oozes whenever he is eating and using the salivary function.

Just inside the mouth at the base of the tongue are the sublingual glands, usually hardly to be seen, looking like little seeds, on either side of Wharton's duct. They occasionally become closed up, accumulation of their secretion takes

place and a true glandular cyst is formed which is called ranula. This is quite a common affection in children; it seems to occur in them more frequently than in the adult. Such a patient will be found to have quite a large sac lying on one side of the frænum. This sac does not look transparent or clear, for the reason that the light cannot shine through it; but looks as if filled with some dark fluid, and its walls look extremely thin. It looks very much like the peritoneal sac or covering of a hernia when distended with fluid; and when you reach the peritoneal cavity and come down to the sac, you are conscious that you have got down to a very thin membrane, but you would say surely that it must be filled with some fluid as dark as blood, because no light can shine through it, and it is not transparent. You incise it, and out comes a clear serum. Incise a ranula and out comes a clear fluid made up of serum and saliva, but it does not look so, as you look at the cyst as a whole inside the mouth, because it is in a dark cavity. So when you look under the tongue you need not think that because it is dark colored that it is necessarily a blood tumor, or vascular nævus, for it may be the perfectly pure limpid contents of a cyst, and simple salivary secretion. These cysts extend very largely. They are larger underneath than on top; project a little ways into the mouth, but dissect backwards between the long muscles and lie under the tongue, and push down to the region of the submaxillary glands, and often surprise you by their bulk. They burst, slowly fill again, and the disease is not cured. To open such a cyst then is not to cure it; and some other measure has to be adopted. Why not do as we do with other cysts; dissect out the entire walls of the cyst, clean out the cavity and let it close? Because it is almost impossible to do so without extensive muti-

lation of the floor of the mouth. The cyst is extremely thin and delicate, can scarcely be got away except piecemeal, and too much dissection has to be done in a vascular and important region. The most effectual measure is to open the cyst in such a way that it can never close, and allow it to granulate up from the bottom. Cut off the top as you would cut off the top of a ball; take off the whole top, leave the cut half below. It slowly granulates. Keep it packed with antiseptic gauze, or treat it with mouth washes, boracic acid, tincture of myrrh, and it will slowly heal, and cannot form another cyst, and is cured.

Another method, very disagreeable and not to be commended although it is successful, is to pass a thread through the cyst and leave it, and drop it inside the mouth, and let it lie there in the form of a seton. The fluid runs out by the side of the thread as fast as secreted and the sac is kept empty. Speedily the invasion of septic matters from the mouth into the sac leads to suppuration, followed by slight abscess, then followed by cure of the ranula. That is effectual, but it is needlessly severe. The better method is to slice off the top; keep it clean, and allow it to granulate up from the bottom.

Many little babies are brought to the doctor with the idea that they are tongue-tied. The tongue-tied child cannot suck. In order to suck, it is essential that the tongue should touch the roof of the mouth. The child cannot be tongue-tied, to do any harm, when it can protrude the tongue beyond the upper teeth. The cases of marked tongue-tie are rare. Whenever it exists, either to a slight or extreme degree, it can be readily cured. The child is held securely; the little slit which exists in the ordinary director is passed down over the frænum; the tongue pushed back, and the

edge of the frænum is nicked. The only danger is in cutting too near the tongue. The ranine veins, which are large, are to be avoided. We protect them by means of the director. It is not necessary to cut much. Merely nick the edge a little ways, tear the frænum with the thumb, and that is all that is necessary. It is not often that the operation requires to be done at all; and when it is done, that is the true way to do it.

XXVI.

AFFECTIONS OF THE TONGUE.

THE tongue swells up from two causes, in either case very rapidly. In each it is very distressing to the patient, and the tongue almost threatens suffocation.

The simple form of glossitis, or inflammation of the tongue, is an œdema, and is not due to the formation of pus. It is of that same curious and rapid type that we see in what we call the transient œdema of the lip, only much more distressing. It usually affects one half of the tongue, either the right or the left half, and does not extend across the entire organ. One side of the tongue frequently looks comparatively small and shrivelled, and the other side is thickened to two or three times its natural size. Raised by the finger and looked at underneath it looks gelatinous and transparent. On top it preserves its normal appearance of red epithelium. The sides are bulged out between the teeth, and the tongue is marked with indentations of the teeth. After it is swollen to a certain degree the patient loses control of the muscles of the tongue and cannot protrude it, cannot push it beyond the teeth. It speedily swells backwards towards the base of the tongue, fills up the space between the soft palate and tongue, and in due time gives rise to œdema of the folds around the epiglottis and the folds of the palatine arches, and in extreme cases may suffocate the patient, if care is not used. That is the form of rapid œdema of the

tongue. If necessary, it can be promptly relieved by incisions. One incision usually is sufficient, if made on the dorsum, about half way between the middle and one of the edges. The large vessels, lingual artery, etc., come in at the base of the tongue, and distribute themselves wholly on the under surface; and you can give quite a score on the dorsum without danger. There is some hæmorrhage, but that is of benefit to the patient. There is a watery and bloody discharge from the mouth for a good many hours afterwards, with relief to the symptoms. Subsequently the mouth can be cleansed with a two-per-cent solution of boracic acid; and in the later stage, if desirable, you can use some mild astringent which will assist. It would not be very safe in this condition of œdema of the tongue to allow the patient to go over night without being carefully watched, unless he had had an incision. It is not desirable to do this incision in your office, because the patient may lose too much blood in going home. Prompt treatment is needed.

Another form of swelling of the tongue is due to abscess. This is rare. It is slower, takes a week or ten days. It is not well defined; and the abscess gets to be quite old before it really gets pointed and defined and fluctuating. It is impossible to tell in the earlier stages whether a case of œdema of the tongue is going to be simple œdema of the tongue alone, or whether it is finally going to end in the formation of a true abscess. The abscesses of the tongue, I have seen, have almost always been about the middle of the tongue, meaning half way from the tip to the base. They are always unilateral; I never saw one extend completely across. The whole half of the tongue thickens and swells; finally a more marked swelling begins to be observed about one point; and.

in an old case, a true sense of fluctuation can be felt. A deep incision may be made there, and a moderate quantity of pus is found and evacuated with entire relief. This, of course, leads to a foul condition of the mouth which requires afterwards careful antiseptic gargling. I should never use an agent like carbolic acid or corrosive in the mouth unless in a state of extreme dilution; the boracic solution is generally sufficient for cleanliness, and does very well.

Abscess of the tongue heals up and granulates and the trouble is promptly over. I have no doubt that a good many of these cases are produced by accidental injuries to the tongue. Abscess is frequently produced by a fall; the patient getting the tongue protruded between the teeth, and bruising the tongue. At first, for a day or two, not much is thought about this, but later, deep-seated inflammatory action comes on.

We speak next of ulcerations of the tongue.

There is a form of ulcer which is very common and very harmless, sometimes called the dyspeptic ulcer; it consists in a little yellowish spot which appears preferably on the side of the tongue towards the base. Frequently there is a group, two or three in a row in different stages of development, some looking like a little epithelial blister, some like a little eroded surface. There is no discharge of any consequence from them. There is not the slightest induration, or change of feeling to the finger when it is passed over the tongue. When you get the patient to put the tongue out on one side you see little excavated spots. They are sore; they are painful. They last some little time; they disappear; and the fact of their getting better and healing within a week or two establishes the diagnosis between them and any form of malignant disease.

Unfortunately the relief of one set of them does not cure the affection, and the patient is frequently soon annoyed by others which appear about the same place; and sometimes there are a number of successive crops. The fact of their rapid disappearance and reappearance, and of their non-induration, and the want of any enlargement of the glands, proves them to be, so to speak, of functional origin, and not worthy really of the name of organic disease. Still they are a source of great anxiety to the patient; and the patient is very apt to think, especially when the second crop comes, that some form of cancer is about to establish itself firmly in the tongue, and to be incurable.

They almost always come in delicate persons with rather anæmic and run-down constitutions; preferably in females. They are along the side of the tongue near the molar teeth, as a rule. They yield as soon as the system of the patient gets in better order.

Remedies addressed to the stomach: antacids; remedies which promote digestion, effect the healing of these ulcers. Locally they require very gentle and very light treatment. If treated with strong applications, like iodine, they are apt not to heal, but to become little irritable ulcers which are slow to recover. Best treated with a pencil of sulphate of copper; or boracic-acid solution, which can be held in the mouth against the ulcer. In addition to this, if we correct the state of the stomach and improve the strength of the patient, the ulcer is apt to disappear.

Cancer of the Tongue. — Now cancer of the tongue has the same locality; frequently comes upon the side; is sometimes thought by the patient to be caused by the irritation of a tooth. It is well-known, of course, that the sharp edge of a tooth, which needs to be filed down and smoothed, con-

stantly resting against the tongue will provoke an ulceration; and this, at first simple in character, may indeed in time become developed into a proliferation of cells like cancer; but it is not always, or frequently the case. Any ulcer seen about the sides of the tongue should be followed by inspection of the teeth, and the edges smoothed off and polished; and if any decayed tooth is projecting very sharply against the tongue, it had better be extracted. Attention, of course, must be paid in all these affections to the condition of the artificial teeth and their plates, whether or not they may be provoking this irritation; and sometimes the simple removal of a little offending cause like this will cause the whole trouble to disappear. Of course it cannot have any effect on cancer, or chancre of the tongue. It is true that syphilis of the tongue usually appears in the form of gummata or cracks about the centre of the organ; and cancer is more apt to appear on the sides and base towards the palatine arches, though that is not a constant fact. Both these troubles are speedily followed by swelling and induration of the glands in the throat; so, just as in affections of the lip, you may expect, whether it is syphilis or cancer, that you will have secondary buboes in the neck.

The cancer of the tongue is characterized always by hardness; indurated, rough, ragged edges; by an excavated centre which is sloughing and foul; by non-healing, absolute non-healing; by very slow extension, the growth and extension being a matter of months, and not of weeks. The dyspeptic ulcer, if it is there, and extends at all, extends rapidly and heals; and the syphilitic affection, when it is tested by specific treatment, speedily heals also.

Cancer of the tongue is a pretty rapid affection after it is thoroughly established, and occasionally destroys life in four

to six months; because it speedily begins to poison the system by septic absorption, interferes largely with the powers of nutrition, is a source of great pain, and wears out the patient by a species of starvation, which rapidly reduces him to a cachectic state, and he sinks under some attack either of septic absorption, pneumonia, or something of that sort.

Large hæmorrhages so as to threaten life are not common in ulcerations about the tongue. If they should come on, they must be arrested by styptics or pressure, or by tying the lingual artery on the side of the tongue affected. It is an artery not difficult to reach, and not deep and not dangerous to tie, being tied along the edge of the hyoid bone. If other means and that fail, we must try to excise that part of the tongue. Amputation of the tongue must be done sometimes. That is moderately safe as an operation. About one-fourth of those who have it done are liable to sink from various after affections rapidly; but three-fourths recover from the operation itself. I will not describe the stages of the operation. It is done either through the mouth; or through the throat; or by sawing the jaw.

After amputation of the tongue the patient is able to speak and articulate tolerably well. He soon gets accustomed, and can speak with a very fair amount of clearness. In cutting off a large piece, it is rather essential, at first, that if the frænum is extensively divided, the stump should be held forward temporarily by sutures in order that it may not drop back upon the epiglottis. Adhesions become soon established, and the patient is not troubled after a short time. Recurrence from cancer of the tongue is the rule; and it recurs almost always in the glands of the neck, and in the throat internally; and is, of course, in the end, fatal.

Lupus of the Tongue. — Lupus of the tongue is tubercu-

lous, and looks upon the tongue precisely as lupus looks upon the side of the nose and upon the cheek. In other words, there are numerous punctate spots of a yellowish color looking like little seeds in the mucous membrane. One or two get broken down and ulcerate. Little yellow sloughs come out of them. They then lose their nodular feel and character, and, after a little while, heal. Others break down and go through the same stages, so that the tongue is covered with scars and ulcers as in case of lupus of the skin. The glands of the neck and under the jaw are affected very speedily. The pain is very considerable. The malnutrition or semi-starvation of the patient, drooling from the mouth, difficulty in swallowing, etc., are all characteristic of this form of disease. It is occasionally also followed by a manifestation of tubercle in other parts; especially the glands of the neck get affected; tuberculosis of the larynx, or of the apices of the lungs is apt to come on, in a certain number of cases.

As to its treatment. Probably in the light of modern methods we should try injection of Koch's fluid to see if a cure could be accomplished in that way. The older treatment was to destroy the lupus with the actual cautery; and in one case I amputated a tongue; and in this case the patient remains well at present.

AFFECTIONS OF THE JAWS.

We shall consider especially those connected with the teeth, and with the antrum and alveolar processes.

Alveolar Abscess. — This sounds like a very small affair, but its consequences are so disastrous that it is worthy of considerable care in diagnosis and in treatment. Usually the alveolar abscess forms in the socket of a tooth, and if the

tooth has been much decayed or loosened, it frequently finds its way up by the side of the tooth, and discharges inside the alveolar socket itself, and thence into the mouth, without any great difficulty; being preceded by a few days of swelling, pain and toothache and followed by discharge. The little opening, through which the pus is discharged, does not heal up, but remains as a little indolent granulation by the side of the tooth, from which occasionally can be squeezed out, or forced out by the action of the jaw, a drop of pus. The tooth is loosened in its socket. Repeated attacks of inflammation about the dentine of the tooth and about the bone occur, and the tooth usually is lost.

Unfortunately there are other forms much more severe. If the suppurative process takes place in the socket of a large tooth, like a molar, which is firmly fixed, the secretion of pus perhaps is unable to loosen the tooth in its bed, because it may form about only one of the roots, and the other one or two roots may hold it firmly in place. It is then unable to escape up by the side of the tooth. It remains in the bottom of the socket, and there it provokes intense symptoms. In the first place, swelling of the gum about the tooth, then rapid swelling of the cheek and œdema of the face even up to the eyelid, and finally closes the eye; so that, in a well-developed, severe case of alveolar abscess, when we are called to the patient in this advanced stage, we may mistake easily the affection for one of facial erysipelas. There is œdema, some redness on the surface, great pain, the patient has had a chill, he is very badly swollen, and looks as if he were very sick. The peculiar eruption of erysipelas, and the raised vesications, are not present; and we should learn at once, on seeing such a case, not to be satisfied

wholly with caring for the cheek and eye itself; but to consider whether there may not be a cause inside the mouth; and examining inside the mouth we invariably find a swollen and tender spot near one of the teeth, usually one of the molars, or bicuspids. If this swelling happens to be outside of the jaw, between the jaw and cheek, we find on opening the mouth that the natural fold is quite obliterated on one side. Pushing the finger along this surface between the gum and the cheek we shall presently come to a point where the patient shrinks and shrieks out with pain; and that is the focus where the abscess is trying to break. If this is promptly and deeply lanced, we generally are rewarded by the escape of a few drops of pus, and the immediate subsidence of the symptoms.

In bad cases the pus does not get out in that way; and although it provokes the œdema, pain and swelling, it does not find its way up the side of the tooth, but drills a hole through the alveolus and comes out in contact with the cheek, causing cellulitis of the buccinator muscle; the periosteum gives way, pus infiltrates into the cellular tissue, and we have an abscess breaking on the outside of the cheek. This is liable to occur in any one; but is more liable to occur in cases that have not been seen and are neglected. When it has taken place, the skin of the cheek, all the tissues down to the bone, are tied down to the jaw; and although the disease may finally get well, this gives rise to a permanent dimple and scar, which are incurable. The pus pours out upon the cheek. It never heals; goes on in that condition, followed by necrosis of the alveolar process; the patient perhaps seeks the hospital, or some doctor, after some weeks, and there is established a sinus, through which, if a probe is passed, it goes through necrosed bone, and down

near the socket of a tooth. This is the stage of alveolar abscess where it has drilled through the socket, and finally escaped through the tissues. Supposing, in the upper jaw, this change takes place in a tooth near the bicuspid, or as far forward as the canine tooth; in drilling through here frequently the pus penetrates the bottom of the socket and goes up through the palate, breaks and finds exit through the nose. In the lower jaw the favorite site to burst is under the jaw. It gravitates down into the neck, makes a sinus, and has been known to point and be discharged as low as the clavicle. Ordinarily it breaks under the chin, and near the symphysis. This is especially so in children. You will see a good many children who come to the hospital, or dispensary, with a sinus here, and on probing, it leads up to a necrosed spot in the jaw and to a tooth. When the exit is low down in the neck, it may be mistaken for other things. Given a sinus discharging in the neck near the sternum it may mean several things; may mean alveolar abscess; but it may mean a fistula opening into the mouth or pharynx from some accidental ulceration of the pharynx or œsophagus; or it may mean, in young children, also, that peculiar form of fœtal malformation, non-closure of the branchial clefts, which cover the large vessels. In that case the probe would pass up to the sheath of the carotid, never reach any bone, and never enter the mouth. If laid open, it would be found in contact with the sheath of the great vessels. These conditions are quite rare; but like the permanent opening of the urachus at the umbilicus, in the child, are seen, occasionally. Given a sinus in the centre of the neck, the physician, or dentist, has always got to ask himself, is it a cleft, or a sinus connected with the pharynx or œsophagus, or is it connected with necrosis; and if necrosis,

then necrosis of a jaw; and of the alveolar process over the socket of a tooth, in which the centre and focus of all the disease will be found to have started?

A process which is capable of so much mischief obviously requires early diagnosis and treatment. Careful search should be made over this pouting, puffing swelling on one side, or the other, of the tooth and mucous membrane, and if a tender point can be found it is safer to make a deep incision by the side of the tooth, at once. If you do not get pus you will do no harm. You will get venous hæmorrhage, but the part will heal. If you get pus, the relief is immediate. If there is a sinus and the pus is discharging itself, then there is no adequate remedy except to extract the tooth; and it is better, in my judgment, that that should be done, than that you should try to preserve it. To preserve a bad tooth with an old alveolar abscess is pretty sure to be followed by recurrent attacks of suppuration, once in six months, or a year; in inclement weather the patient is seized with fresh toothache; has another abscess form about the tooth; has the bone become still more diseased; runs the risk of permanent necrosis; and runs the risk of his health being interfered with. When alveolar abscess has once occurred, and drilled through and loosened the tooth, I think the best cure for the patient is to extract the tooth itself. Sometimes it is necessary to go down and scrape the bone; and dilate the sinus, until the bone can heal.

These long sinuses are annoying. It is hardly justifiable to slit them up in their whole length; and the best thing tc do is to slit them up moderately, and dilate and syringe them out. Find the trouble, extract the tooth, scrape the bone, and wash through and through, repeatedly, until healing takes place.

Alveolar Hæmorrhage. — Rather an annoying thing. Follows the extraction of a tooth in a certain number of patients; not always patients who are what are called bleeders, yet frequently it is in the class of patients called bleeders, who bleed from a cut profusely, and who bleed from the extraction of a tooth.

How to arrest it? Usually, where the socket is firm and strong, by plugging; and keeping up pressure firmly with some material like a little gauze; antiseptic cotton at the bottom, followed by something that will set when put in, like wax. If these means are not at hand, it may be arrested by putting in some antiseptic cotton moistened with ferric alum, and the whole space between the jaws packed with cotton, and the teeth shut down. If this means fails, the best remedy is by the actual cautery; the galvano-cautery; putting a fine platinum wire in the socket and searing the vessels. If we have not that at hand, we may heat a knitting-needle red hot, bend it to a proper curve, plunge it into the parts, and sear until the hæmorrhage is stopped. A bright red heat must not be used; but it must be of a dull color before the iron is applied to the bleeding point. The bright red heat ulcerates into the vessel deeper and makes it bleed more. The dull heat coagulates the albumen and stops the bleeding. In hæmorrhage from a lower molar, I have trephined the jaw and secured the inferior dental artery.

Sometimes a misplaced tooth, or one which is imperfectly formed, causes a dentigerous cyst. These are more common in the lower jaw; seem to be more common in the first molars and bicuspid teeth. They may at first be mistaken for ordinary cases of periostitis about the lower jaw. You know how common it is to have a periostitis about the

lower jaw in case of toothache; adhesion taking place about the jaw and the mucous membrane, and nodule resulting.

If we examine the mouth of a patient with a dentigerous cyst, we shall find a tooth is wanting opposite the point where the swelling occurs; and the gum is bulged out and swollen on the inside, as it does not do in simple periostitis. In the advanced stage we may find a peculiar feeling of crackling like stiff paper when we press upon the gum on the inside; just as is felt in the antrum when there is a cyst, or abscess there, which has thinned the bone.

The diagnosis of dentigerous cyst should be made by the age of the patient; by the imperfect state of dentition; by the absence of the proper tooth at that particular point; by the long duration of the swelling, and the fact that the swelling is inside of the gum, as well as showing outside on the jaw.

This affection is slow, and moderately painful; no tooth appears; the swelling goes on increasing.

The treatment is simple; much more so than was formerly thought. In former times, before the nature of the affection was fully understood, excision of a portion of the jaw was done to remove the supposed malignant cyst. What used to be considered a malignant cyst is known now to be merely an expansion of the alveolus itself, with a misplaced tooth lying across the bottom.

The treatment is to score inside; break through the bone all around; break off the roof of the cyst; wipe out the contents; which usually consist of a thick fluid; search carefully in the bottom with good light and we soon find the cusp, or fang, or some portion of a tooth. If it is in a tolerably good direction, pointing in a good direction, it may be left and it

will come up to the surface. If it is obviously malformed and misplaced, and cannot be corrected, it had better be extracted.

The after-treatment is very simple; it merely consists in keeping the cyst carefully washed out; and the disease cures itself after some weeks.

We cannot insist too strongly on the diagnosis and easy treatment of this affection, in view of the fact that within our recollection jaws were excised for dentigerous cysts, before their nature was perfectly understood.

Wisdom teeth, a good many times, come through with difficulty, and make many curious symptoms. I have known one or two instances where patients, who have passed the age of thirty, have had an eruption of wisdom teeth; and who, on account of the gravity of the symptoms lasting so long, were considered to be the subjects of malignant disease of the jaw, far back in the throat. The tooth cannot get out, and provokes the same class of symptoms as in the dentigerous cyst; swelling of the jaw, swelling of the lymphatics, intense and constant and worrying pain; so that unless the diagnosis is made, the case appears extremely threatening. It is in these cases that deep lancing speedily liberates the tooth, and the patient gets well in a short time. I have known cases that have gone round for weeks in this condition, and have had the diagnosis of cancer of the jaw made. We cannot be too careful in observing inside the mouth the number, position, absence or presence of the teeth, in their proper spaces; and on that we can base, often, a satisfactory diagnosis.

NECROSIS OF THE LOWER JAW.

Necrosis of the lower jaw is frequently the result of injury; a blow sometimes breaks the jaw; and fracture of the jaw is

frequently followed by necrosis. A blow and a wound over the jaw, laying bare the bone, but not breaking it, is occasionally followed by necrosis. It occurs after severe cases of scarlet fever; of measles; and sometimes necrosis is a direct consequence of alveolar abscesses, long neglected.

Necrosis of the jaw makes a sinus on the outside precisely like the sinus of alveolar abscess. The skin is fastened down around the bone; the probe passed in comes down on fragments of bone, and the diagnosis is made.

The treatment is not so easy as the diagnosis. Unless the sequestrum is pretty thoroughly loosened the disease will not be arrested by attempts to remove it. If you find it and semi-detach and chisel it away, the consequence will be an almost inevitable renewal of the necrosis on the surface whence it is taken away; whereas if it is loose and taken away, speedy repair takes place.

Nowadays, it is not so common to have necrosis of the jaws from phosphorus, as formerly. In match-factories the operatives take care of themselves, and the inroads of phosphorus have been checked. It is said that a person with perfectly sound teeth and a healthy mouth can work in the fumes of phosphorus without danger; that there is necessary for infection a decayed spot through which the fumes can enter and affect the bone. Certain washes may be used to guard against this evil. Respirators are sometimes used.

Phosphorus necrosis is not very common now among the match-makers. When it occurs, it is very peculiar and extensive. It is different from other forms of necrosis. It involves large pieces of bone; strips off and separates as a sequestrum perhaps one-third of the lower jaw. When we probe, we find the bone denuded in every direction; and by and by a large piece of bone may be extracted, entirely sep-

arated from the jaw. The hopeful part about these cases is this, that however much the disease has injured the jaw, a very rapid effort at repair goes on. If we can slit up over the diseased surface and lift out the sequestrum, new bone forms; and in some cases a large portion of the jaw has been re-formed. This is, of course, imperfect. Alveoli and sockets and teeth never re-form; but if you get a firm bony bridge, artificial teeth can be worn; the parts heal over, and the patient does very well.

EPULIS.

A peculiar form of tumor of the gum and periosteum forms on the jaws, preferably on the upper jaw. This is called epulis. It looks at first, and for a good while, exactly like the tissue of the gum itself. Eventually, as it grows larger, although it grows firm and dense, it looks more like a piece of India-rubber taken from the tree in its white state. It grows preferably on the upper jaw, generally on the inside towards the palate process, along the bicuspid or molar teeth. In other words, in this patient the first thing that is noticed is that the gum is thickening. No pain; the gum does not look different from its normal state except that it is thickened. There is no other evidence of disease. Eventually this whitens and grows hard and firm, and spreads out upon the palate, and sometimes attains a growth as large as the thumb. It remains in this state a long while. I do not know what the natural history of it would be if left to itself; for almost always these patients, sooner or later, are operated upon. It is capable of attaining a large size.

This is curable by being excised; and, as a rule, it does not return; and the patient sees the last of it; but it can only be excised with safety against recurrence by taking away the bone from which it grows; and if it grows on an

alveolus, a tooth must be sacrificed and the alveolus chiselled away thoroughly; otherwise, it recurs from the periosteal layer which is left; and if it keeps recurring, it may do what so many other growths do; they become softer and softer and more embryonic, and finally develop into soft colloid cancer, which is essentially malignant.

To recognize this affection is the first step; and as soon as it is recognized excision should be urged. The patient at first is unwilling to have this done because it is painless. The teeth are sound and strong, and they are unwilling to sacrifice the teeth and go through an operation. However, after a few months it grows so fast that they consent. In one or two cases it has become necessary to cut out a piece of the palate process as well. If you can preserve the external arch and the alveolar process, the patient gets along well. It cannot be too strongly insisted on that the time to treat epulis is early, and treatment must be thorough. If it is left to grow, and recur, and ulcerate, it will probably become a truly malignant affection.

The diagnosis is to be made by its being essentially a tissue exactly like the gum in appearance; finally, growing white and elastic and firm, like India-rubber; but, still, always smooth and hard and painless.

AFFECTIONS OF THE ANTRUM.

The antrum is the seat of a great many affections. It is, as you know, a large cavity in the upper jaw which communicates with the middle meatus of the nose. Into its base project the sockets of one or two of the molar teeth. It is a large cavity, and communicates constantly with the external air. The opening into the nose is liable to become obstructed by outgrowths on the turbinate bone; by affections of the

mucous membrane, like chronic catarrh, or by polypus; and when the opening is obstructed the secretions of the antrum are unable to escape. Then takes place what is called

CYST OF THE ANTRUM.

It is merely a retention of its natural fluids unable to find their outlet through the nose.

The consequences which follow are quite peculiar. The walls of the antrum are very thin both up towards the orbit and forward towards the face. Very speedily after the cyst has formed the palate process becomes pressed down, the orbital process pressed up, and finally the natural depression below the zygoma is lost, and the patient seems to have quite a nodulated large swelling pushing out below the orbit. We find that the palate process is so pushed down that on pressing the finger up inside we get a sense of fluctuation and yielding there. This is ordinary cyst of the antrum. It is painful. If it goes on, it eventually ends by loosening one or two of the molar teeth in their sockets. It is an innocent affection, and ends by a spontaneous breaking through, or by an operation; or terminates in the formation of pus, and then becomes what is called

ABSCESS OF THE ANTRUM.

In that case the symptoms become more intense; the ordinary symptoms of suppuration, fever and chill; and eventually it breaks through the cheek, or, more frequently, down through the palate into the mouth.

When this affection is recognized, the treatment is very simple; either to extract a tooth and treat it by affording vent through the socket of one of the molar teeth; or make an opening through the outside of the gum, so that it may

be syringed out, and kept clean and drained. If a molar tooth is extracted and an opening got in that way, an instrument may be put in to ream out the socket and cavity, so as to make a free opening into the antrum; at any rate, the part must be prevented from closing. The parts must be constantly syringed out with antiseptic solutions until healthy secretion can be restored.

Frequently these affections last a long while. A sinus remains leading into the antrum; and it is necessary for the patient to syringe out the antrum daily.

SOFT CANCER OF THE NASAL PASSAGES AND ANTRUM.

In this connection I wish to speak of another disease which is so like what we have described and so rapid and fatal in its effects, that we must be careful to make the diagnosis. Soft cancer grows frequently in the nasal passages and antrum; perhaps begins as malignant polypus in the nose; then grows from the nasal cavity into the antrum, distends the antrum and pushes up the orbit; thins the bones, depresses the palate process, thins that, and gives all the appearances of a retention cyst, or an abscess of the antrum. Its progress is not so rapid. Its pain is not so intense. It attacks people, it is true, usually at a different time of life; cyst of the antrum and abscess of the antrum occurring preferably in younger people; and cancer usually coming in people at, or past, middle age; still the growth of soft, sago-like, gelatinous substance in the antrum is very difficult to distinguish from suppuration, or a cyst. This process, after a little while, loosens two or three teeth, which begin to shake in their sockets; and eventually are thrown out. In the socket there appears a little fungus granulation which bleeds on touch.

In the case where the antrum is thus dilated we proceed to extract a tooth, or to puncture through the palate process up into the antrum, and are rewarded by a little flow of serous fluid, or pus. If blood comes, and then some little granulations which look like boiled sago, you may be pretty sure we have to deal with a cancer; and that the patient's life is certainly in immediate danger; for the chances of recurrence after operation are very great.

Loosening of the upper teeth not due to mere absorption of the gums, which is common in old people, but loosening of the teeth in gums looking pretty healthy, with a thickening of the palate process, are warning symptoms, in middle-aged people, of malignant disease forming. A puncture should be made, and the growth, if it is one, diagnosticated; and the cyst or abscess emptied and washed out. Provided we have malignant disease of the antrum, then we have no resource as regards its treatment except to excise the bone with the disease itself; and that means excision of one half of the upper jaw, entailing considerable mutilation, although the patients get along better than you would suppose. Unfortunately it often happens, that by the time the disease has been thoroughly diagnosticated and the surgeon proceeds to excise the upper jaw, he finds, after taking away the antrum, that the disease has spread to the sphenoid cells, and although you scrape it and cleanse it, recurrence generally comes on after a very few months; and the disease extends up to the brain, and the patient perishes, in consequence.

OBSTINATE SINUSES.

In and about the sockets, in consequence of slight necroses and alveolar abscesses inside the mouth, there occasionally form very obstinate sinuses, usually due to what is called an

ulcerated tooth. After the ulcerated tooth, so called, is extracted, the sinus still remains; and it will be found to extend up, perhaps, through the socket of a canine tooth; or, more frequently still, to run off over or under the palate process; frequently extending on the palate process, down behind the uvular and discharging behind the palate process.

Now these sinuses are hard to diagnosticate; difficult to probe; difficult to syringe out; and extremely hard to cure. I have found several which have gone on three or four years before they could be finally healed; and the only way to treat them is by taking out a neighboring tooth, sometimes; and getting a wide opening into the sinus; syringe and probe daily; and apply stimulating applications to promote healing.

These are a great source of trouble because they keep up a little filthy discharge, and annoy the patient constantly. If they are large enough, air gets in, and a slight sucking noise is made on talking and eating.

These are comparatively frequent, and hard to cure. The patient becomes very much disheartened. It is not justifiable to do a very formidable surgical operation. You have to content yourself with keeping the outlet enlarged and free; constantly syringing and dressing the parts, until they can finally heal.

ANCHYLOSIS OF THE LOWER JAW.

This is, almost always, fibrous; due to a variety of causes, sometimes abscess; sometimes to slow forms of chronic rheumatism; sometimes to scarlet fever, and occasionally to chronic trouble about the wisdom teeth. It occurs especially in children. The mouth becomes more and more stiff. The

jaws open with more and more difficulty. The child is fed with a spoon; and as time goes on this anchylosis becomes more and more complete. It is almost always on one side only. Of course if one side is held firm, the other side is unable to act. The stiffness, pain, cracking will guide the observer to the side which is diseased. This condition will sometimes persist from the first through the second dentition; and it is a very remarkable fact that a second dentition will go on and be well completed, and the first set of teeth got rid of, without the child being able to open the mouth wider than to get in the blade of a knife. Nature thus disposes of the whole matter inside of the mouth without harm to the individual; but the question arises of course as the child grows older, what is to be done to overcome the anchylosis.

In very mild and commencing cases blistering, leeching, etc., may suffice to prevent the trouble from happening; but when the trouble has happened, the first step is to etherize the patient, and see if the jaw can be forced open by moderate means. This treatment by wedging the jaw is moderately successful. In many cases this will fail; and it then becomes necessary to do something more. The best way then is to make a false joint by cutting through the lower jaw, leaving the original anchylosed joint in position, but setting up a centre of motion a little farther down. The place of selection for doing this is pretty high on the ramus, because we have to rely on the attachments of the masseter and pterygoid to move the jaw after the cut. We saw pretty high on the ramus, and establish a false joint. That has been done very successfully many times, with subcutaneous tenotome and a saw within the mouth; and sometimes without subsequent necrosis; so that by

antiseptic treatment, cutting gently through the mucous membrane and sawing through the jaw and taking care to keep up motion so that union shall not take place, we eventually establish a false joint, with which the patient gets along extremely well; and the subsequent deformity is not great.

XXVII.

AFFECTIONS OF THE THROAT.

Elongation of the Uvula. — This is common. The patient complains of constant tickling, has necessity of hemming all the time, and hacking to clear the throat, makes efforts to swallow every few minutes. On examining these cases we shall find a long and pendulous uvula which drags upon the tongue. It is so œdematous that its end is almost transparent. It is increased to one-third or one-half more than its usual length; long, tapering, lightish in color and looking as if full of water. It lies upon the tongue, and gives the constant feeling of a foreign substance.

The simplest treatment is the use of astringents, which may be varied from tincture of myrrh, etc., to tincture of iron. When this affection is there and acute and has not existed long, these measures are quite sufficient. When it is chronic nothing will cure it except excising the uvula. Amputating the uvula has to be understood in this sense. We only wish to cut off the tip; one-third to one-half at the most is all that should be cut off. The tip is seized with a fine pair of hook forceps, the patient's tongue held down by an assistant, and the uvula is cut across by a pair of straight scissors. Cut square across at one snip and then you get a good shaped stump. The remaining portion or stump of the uvula shrinks up, and we have left a uvula which is sufficient, but which still shows its shape; whereas, if we pursue the old plan of cutting off the whole uvula up to the palate,

it shrinks and leaves the palatine arch as a complete hemisphere without any projection in the centre, and is a needless mutilation, as well as injurious. Then the soft palate is incapable of perfectly closing off the nose from the throat on certain occasions where it is accustomed to do so; whereas if some be left, it can still accomplish that act to a fair degree. All these mutilations are said to impair the voice to a certain extent in singing; hence that must be taken into consideration before undertaking the operation. It makes the patient's throat very sore for a few days. The patient had better be told that he will be unable to swallow anything but liquids for a few days, and that the act of swallowing will be painful. It heals in two or three days; and I believe never leads to any other consequences, provided it is carefully done.

Most cases will get well with astringents; a few may be amputated, to a limited degree.

AFFECTIONS OF THE TONSILS.

They are very numerous. The simplest form is

Follicular Tonsillitis. — This is an inflammation of the tonsil, with over-secretion from its follicles; in the chronic form, the hardening and setting in the follicles of the secretion appears like little white beads dotted over the tonsil, without pain or sore throat. The ordinary state of acute follicular tonsillitis is accompanied with redness, swelling and pain. It is a very common affection; usually known by the name of ulcerated sore throat. It is an accompaniment of many colds. The symptoms are very much more severe than the disease would appear to cause. There is almost always a chill and backache; aching of the limbs; high temperature for a day, or two; and difficulty in swal-

lowing. The affection usually appears on one tonsil; and then, after two or three days, subsides, and passes over to the other tonsil; so that about five days are consumed in the course of the disease. Occasionally, in severer cases, it begins on both tonsils at once; but that is not the usual history of ordinary follicular tonsillitis.

The treatment consists in giving a saline cathartic; perhaps some sedative to enable the patient to sleep; the use of gargles, and possibly painting the tonsil. The milder forms of gargles are sufficient. A good one is one drachm of dilute muriatic acid, one drachm of chlorate of potash and four ounces of water. This suffices; and dissolves the spots rapidly. The objection to it is the effect it has upon the teeth. The patient must gargle very carefully; and brush the teeth either with a solution of soda and water, or rub the tooth-brush over a common toilet soap, and cleanse the teeth with that; and then with pure water. In that way the teeth are not injured.

If the case is more severe, we may apply the tincture of muriate of iron, or muriate of iron and glycerine, with a brush, to the tonsils.

This disease is prostrating; and the patient must be well fed with nutritious liquids; kept warm; and given tonics like iron and quinine. In that way the disease is brought to a close within a week.

Very rarely, in tuberculous and feeble subjects, especially in children, simultaneous swelling of the lymphatics about the diseased tonsils takes place in the neck; but this is not common. The important point about this affection is in distinguishing it from diphtheria. This is a point about which we are always anxious; and the location and minuteness of the beads; their coalescence; their extending beyond the

tonsil onto the soft palate or pharynx, would seem to be the best indications as to the diagnosis. We have sometimes additional information as to exposure to diphtheria, or non-exposure to anything; but the history is generally of not much value, unless other cases of the disease happen to be in the same house.

The diphtheritic patch is, as a rule, larger and thicker and more gray. It speedily extends beyond the tonsil upon the soft parts. When it comes off, the diagnostic test is complete, for the spot of follicular tonsillitis separates and can be rubbed off from the mucous membrane without leaving any raw surface behind; and the diphtheritic patch, if it is hastened, comes off leaving a raw and bleeding surface. It is more tenacious, bigger, more offensive; but the important point is this: that the early symptoms of diphtheria, accompanied with patches in the throat, are not usually so severe as the early stages of tonsillitis. Simple, innocent, follicular tonsillitis, in the child, will make the child appear much sicker for the first thirty-six hours than if it is the onset of diphtheria. Of course, as the disease goes on, the diagnosis becomes more easy of the diphtheritic condition; but the anxiety in the mind of the parents and physician always is in the first twenty-four hours; whether we are going to have a limited and simple follicular tonsillitis, limited to the crypts of the tonsils without subsequent infection; or whether a true diphtheritic membrane is going to develop. If opportunity occurs to subject the secretions or the membrane to microscopic examination, the Klebs-Lœffler bacillus, if present, will determine a diagnosis of diphtheria.

Enlargement of the Tonsils. — The tonsils in many children, especially those of what is called the lymphatic temperament, are the site of chronic enlargement. This is not

continuous. It is remittent, so to speak. The tonsils are always a little larger than they ought to be; but occasionally become a good deal larger than they ought to be; and then subside. This is due to taking cold. The tonsils swell up, and after a few days go down. These attacks are frequent. The tonsil, however, never regains its natural size. Usually the affection is on both sides. Very frequently, however, one tonsil becomes enlarged much more than the other; and when both are much enlarged, on opening the patient's mouth, looking in, and encouraging him to say the word "ah," and to inspire to lift up the uvula, it will be seen that the two large tonsils block the passage and touch each other. If this chronic condition goes on, certain other symptoms invariably arise; for instance, a change in the tone of the voice; it is nasal; constant snoring at night; heavy and labored respiration whenever the child has a cold; and breathing with the mouth open in extreme cases.

The additional consequences which may follow on this chronic state are much more serious. If these two tonsils lie constantly interfering with the passage, they interfere very much with the ingress of air; and subsequently, if they are allowed to remain untreated during the growing period, they lead to contraction and deformity of the thorax; what is called pigeon-breast; a narrowed chest; limited capacity of the lungs speedily follows this prolonged interference with the column of air; it is constantly present and diminishes the air-supply day and night. Such a condition as this calls for interference.

In the early stages we can try strong astringents and iodine, but if they do not succeed, we must try excision of a part of the tonsil; the excision of a good mass of the projecting portion leaving a square surface about flush with

the palatine arches is sufficient. Cut off enough to restore the natural inlet to the throat. I am not aware that any permanent injury follows this mode of treatment. In old times they were cut off by seizing with a curved hook, dragging them forward and taking them off with a pair of curved scissors. Now we have an instrument which cuts them off, which is a species of guillotine. The danger of the operation is trivial. We are warned not to cut outwards, or too deeply, for fear of wounding the carotid. The tonsillar artery is much more apt to be wounded than the carotid. It is safer to cut towards the central line. With the guillotine we hardly run this risk.

There is, however, in this excision of a portion of the tonsil, danger, if we do not choose the right time for the operation. If we choose the time when the tonsil is going through one of its inflammatory attacks, when it is worse than it has been for a week or two before, red, inflamed and congested, that is a poor time to operate. We shall always have an annoying hæmorrhage, difficult to check. The interval between attacks should be carefully selected, when the tonsil has returned to a pale red color; looks œdematous, but is not inflamed.

Adenoid Growths. — Over-growths of mucous follicles and glandular tissue have been found and removed from the vault and back of the pharynx under the name of adenoid growths. Sometimes these alone are diseased and the tonsils not. The symptoms of these adenoid growths are the same as those produced by the enlarged tonsils — deafness, snoring, breathing by the mouth, chronic catarrh, etc.

These growths are removed by scraping out with a curette, or partially with the finger; the child being, perhaps, etherized for this purpose; but ether is not necessary for excising

the tonsil. You want an assistant to hold the child's head solidly, put in a gag, pass in the tonsillotome and take off a portion. The struggle is with the second tonsil.

Moderate bleeding is the result, and the stump shrinks up.

Abscess of the Tonsil. — The most serious acute affection of the tonsil is abscess; what used to be called quinsy, the quinsy sore throat. It is a peritonsillar abscess, not in the tonsil, but about it; just as the perinephritic abscess is in the cellular tissue about the kidney, but not in it. It forms around the tonsil, and preferably dissects its way behind the tonsil.

Its symptoms are intense; duration five to seven days. The tonsil swells up, the patient is unable to swallow, drooling takes place, great pain, earache, and sometimes the patient is unable to sleep, or swallow, for several days. Finally, if left to itself, the abscess breaks, and the relief is immediate. It, however, often fills up again, after breaking through a pin-hole, and the symptoms are repeated in a milder form; and then it breaks again, and, usually, after that, is cured. Very many of these cases which are seen in quite an acute stage, where the surgeon thinks perhaps they are not sufficiently ripe to be lanced, break of themselves in the next two or three hours, in some obscure point. Sometimes the patient does not know it has broken except from the sensation of relief. Then you must not be deceived if the patient says it has not broken. In that case the break is low down; happens at the very edge of the pharynx, the pus is swallowed or partially expectorated, and the abscess is effectually drained.

One would think that cocaine would afford a good deal of relief to these cases. It is said to do so. My own experience with it has not been very successful. It is a proper

thing to use and try. A moderately strong solution may be repeatedly painted on the tonsil and palate, just before you wish the patient to take nourishment. It is said that a good deal of temporary paralysis to pain is produced in this way, as well as tolerance of the throat; but in order to have this succeed, I think it is necessary first to rinse the mouth out, then to swab it out carefully with dry cotton, and the moment you have a moderately dry surface (for the throat is covered with a viscid, sticky secretion) instantly paint on the cocaine. In that way you may get relief in some cases, and in some you do not get it. It is hardly safe to give much opium in these cases. The tonsil swells up very largely; œdema of the glottis is liable to take place at any time. The patient won't lie down. He sleeps what he can in the sitting attitude, in order to allow ingress of air in and out by the side of the mass. This disease is accompanied with a great deal of suffering and prostration. It is difficult to nourish patients, difficult to give them sleep; and the physician or surgeon feels quite anxious until the disease has reached its climax. He is quite sure that from five to seven days will terminate the affection. It never runs longer than that.

Opening the abscess is a sure mode of relief, provided we reach the pus; and the relief given is marvellous and immediate. The difficulty in reaching the pus is in finding the fluctuating point. If you merely stab into the tonsil, you are conscious that your bistoury has gone into a solid mass. Nothing comes but blood. No relief follows. It is better to be pretty sure that the state of fluctuation can be well made out before an incision is made. Here it is necessary to guard against cutting back towards the carotid vessel; and the incision should be made drawing the blade towards the centre of the mouth. A sharp-pointed curved bistoury is the best,

which should be wrapped firmly with some twine within half an inch of its point; or let the finger be the guide, and keep the finger to press back the cheek in the region of the carotid. Drive it in, and cut towards the uvula. My own experience is that the abscess generally points first just above and behind the tonsil in the soft palate; and I generally succeed best by plunging through the soft palate, a little downwards and inwards. If you get pus, try to make a pretty good slit in withdrawing the knife. No subsequent treatment is necessary except gargling the mouth.

Now comes another important part of this affection, its recurrence — not within the next year or two years, but once in six months. The patient who has once had abscess of the tonsil is very apt to have it form again, and in the same location; and he knows what is coming by the intense suffering. Can anything be done to abort it?

I think it can. Formerly I thought I accomplished a good deal by strong astringent applications the moment any symptoms were discovered. Latterly, I have become convinced that applications on the skin of the neck outside the tonsil have about as much effect. There are two methods which seem to me effectual. One is kerosene oil, applied to blister. The other is a domestic remedy, but seems to be very effectual, and that is made from the leaves of common mullein. The patient sleeping in one of these poultices is frequently rewarded by the abortion of an attack. These little points are worth remembering; because one who has once gone through with tonsillar abscess is in great dread of a subsequent attack.

Cyst of the Tonsil. — Now there is a chronic abscess of the tonsil called a cyst. This I have seen mistaken sometimes for malignant disease. In this case you find that the

patient is of pale, lymphatic temperament. One tonsil is a little enlarged and soft, but rather bulges out and hangs down. It is not much lighter in color. If you can get your fingers in and palpate, you will be aware that you have a sac of fluid. This sac is frequently a mucous cyst, or a cold abscess.

Free incision cures the complaint.

Concretions in the Tonsils. — There is another form of chronic affection of the tonsil, which consists in the formation in it and about it, of salivary concretions; little chalky masses which form in the follicles, become hardened and inspissated. They can be scored across and turned out with the curette.

Syphilis, Cancer and Sarcoma of the Tonsil. — The tonsil is the site of both primary and secondary syphilis, of cancer and of sarcoma; rarely of cancer, rather more frequently of sarcoma, occasionally of syphilis.

The primary chancre of the tonsil is a ragged, indurated, bleeding, indolent sore, followed or accompanied speedily by lymphatic enlargement outside the neck, and by other manifestations of syphilis. Cancer of the tonsil and sarcoma are slower in their formation. In chancre of the tonsil, the history is short. In cancer or sarcoma, it is a month or two, usually, before you see the patient.

Sarcoma occurs as a firm, fleshy mass. Cancer becomes indurated, with infection of the lymphatics. In these two latter malignant affections, the only possible relief is to try to excise the malignant growth; and it is very difficult to do it within the mouth and get out the whole of the disease. Consequently, the better operation seems to be to attack it from the outside, cutting beneath the jaw and going down until you open the pharynx, and scooping out the tonsil from

the bed in which it lies; or if that does not give sufficient room, you can saw the jaw and turn it up, and get a good deal of room in which you can explore the tonsil and all the parts about the pharynx, and remove the tumor with ease. The opening of the pharynx is followed by no worse consequences than by opening it for foreign bodies. No sewing up is necessary, and the part speedily heals.

RETROPHARYNGEAL ABSCESS. — TEMPORAL ABSCESS. — ABSCESS OF THE PAROTID. — DEEP ABSCESS OF THE NECK.

Now I am going to speak of four forms of abscess that are extremely important, and difficult, sometimes, to diagnosticate. One is the retropharyngeal abscess; one is called a temporal abscess; one is called abscess of the parotid; and the other is called deep-seated abscess of the neck, in distinction from the others.

Retropharyngeal abscess in almost all cases is due to caries of the cervical vertebræ in feeble children with Pott's disease. It is a cold abscess; begins as a bulging, irregular, œdematous, and later a fluctuating swelling, up behind the palate, at the back of the pharynx. This projects, and interferes with respiration and with swallowing; and if it is not treated and opened, its tendency is to burrow down behind the pharynx and reach finally the posterior mediastinum, where it speedily tends to septic, or fatal results.

Recognized, it is important to open it. The child can be etherized, can be inverted, or held with the head back in such a way that the fluid will not trickle down into the larynx. If you wish to be extra cautious the little sac can be aspirated first to see if it contains pus; and after that, with sponges to keep the liquid out of the larynx, the abscess should be freely

slit up, and washed and curetted out. This relieves the immediate symptoms. Like opening any other cold abscess it does not cure the patient.

Abscess in the temporal region is very peculiar. It comes under the temporal fascia and peels up the temporal fascia, pushing aside the temporal muscle, and is imbedded, so to speak, under this very strong fascia, which prevents the bulging out of the temporal muscle when it contracts. This form of abscess usually follows some septic infection, as scalp wounds or erysipelas. It is not common.

The symptoms are intense. The patient is obscurely sick, and complains of headache in this region. There is hardly any swelling. The temporal fascia holds the part firmly down. The pain is in proportion to the retention of the pus. Intense headache, chills and other symptoms of suppuration, finally œdema coming on about the temple or cheek, marking the extension of the abscess, and affecting neighboring parts by pouring out a serous effusion. This abscess, if left alone and the patient survives, bursts in the mouth near the molar teeth. It is a very curious affection, and its diagnosis is important.

If recognized, the treatment, of course, is like that of any other abscess. A prompt incision should be made; the temporal muscle cautiously slit up; a director put in, and the pus sought for; and finally you will be rewarded by a gush; curette, cleanse, open the whole cavity and keep it cleansed; and if the disease has not lasted so long as to denude the periosteum of the temporal bone and to lead to necrosis and caries, the patient promptly gets well. If it has, you have got to keep the cavity open and wait for exfoliation.

You will not see a great many of these abscesses. They

are very obscure. They were best described by a French author some years ago. If you do see one and can make the diagnosis, the success in opening them is very brilliant as regards the comfort and safety of the patient. After septic infection from a scalp wound, after a blow about that region, or erysipelas of the face and scalp, is the time to expect this form of abscess.

Parotid abscess is a very different thing. It is a parotitis, like mumps, followed by suppuration. This suppuration is never in a large sac. It is septic, I think, always, in its character. I have seen it follow scalp wounds where they have become septic and the glands of the neck were affected. It is occasionally the result of blood-poisoning from low forms of typhoid fever and some other affections. The parotid swells up as in mumps, does not subside, remains indolent and painful, and finally fluctuating points can be found in it. Now, here is the particular part of which I wish to speak. It is not a sac of pus that can be made out; it is a series of sacs; little pockets scattered about. You open this, that, and the other, with various incisions; and in a day or two you have more pain, and have to open one or two more. If the patient survives the disease which brought it on, and prompt issue is given to the pus, it will heal up. The only drawback is a salivary fistula. This, too, will heal after a little while, if touched with caustic. It is not necessary that Stenon's duct be opened for a fistula to occur. These abscesses are all interesting and peculiar things.

Quite as rare and much more fatal is the deep-seated abscess of the neck, of which the hospitals see perhaps three to six cases a year, and a private physician, perhaps, not one in five or six years. It is a cellulitis followed by

the formation of pus; acute; under the deep cervical fascia; usually somewhere about the sheath of the vessels near the sterno-mastoid muscle. Its symptoms are obscure. The patient has difficulty in swallowing, difficulty in breathing; the voice is affected, becomes hoarse. On looking into the mouth absolutely nothing is seen. The velum and palate and tonsils and back of the pharynx, and probably all the parts below, are found free from irritation, except congestion of the vocal cords from pressure; but I am inclined to think the dyspnœa produced is not due to pressure of the pus upon the parts about the larynx, because they are strongly protected by the box of the larynx, but by pressure on the inferior or superior laryngeal nerves. At the same time, from pressure on some fibres of the pneumogastric, difficulty of swallowing, and imperfect action of the constrictors of the pharynx follow. The patient does not show anything inside of the throat; but speedily there begins to show on one side of the neck a brawny, indurated swelling, but generally no redness. There is inability to move the neck, and œdema, together with marked and severe constitutional symptoms: chill, high temperature, sweats. This means pus in deep, beneath the deep cervical fascia. If diagnosticated and reached, the patient is almost always saved; if not, they are generally fatal; and this by running down into the mediastinum and pleura, or breaking into the back of the trachea, or by suffocation. It is an extremely serious affection, and, the whole point consists in making an early diagnosis; and, having made it, in pursuing the proper course, which is to seek for the pus. We make the incision on the front or back of the sterno-mastoid muscle; the back is usually farther away from the pus. Then we take a director, and begin to bore carefully into the soft

tissues of the neck; or we may get in the little finger. At first you may be quite disappointed. Finally, far up behind the styloid process, you get a gush of pus; enlarge the incision, insert a drainage-tube and wash out the whole cavity. Usually a free opening on one side, with drainage and syringing, suffices to relieve the trouble. The relief is wonderful, and recovery is prompt. They generally get well in about a fortnight after the incision is made.

HYDROCELE OF THE NECK.

Hydrocele of the neck is a curious thing. It is a multilocular cyst, either congenital or growing very slowly. Becoming a little pouch, it pushes up and down in different parts of the neck; sometimes projects in the little triangle below the clavicle; and not infrequently descends into the axilla and makes a fluctuating sac there. This is a serous sac with extremely thin wall; might be likened in a certain way to a ranula; a very thin, adherent wall; secreting a sticky, viscid, albuminous fluid, something like the bursa of a synovial sac; produces no symptoms, but enlarges. As the child grows, it begins to project and hinder the use of the arm. At first, perhaps, the surgeon thinks on looking at it he has to deal with a simple cyst which can be excised; but if he attempts it, he soon finds out his mistake. If he examines it carefully, he finds pockets going down into the axilla; in fact they are sometimes very extensive. It is practically impossible to dissect out the sac. The sac is involved with important parts. The treatment is to make thorough openings, wash out and drain, and pack antiseptically, until it can shrink up and heal as a ranula does. It is a serious operation, and is liable to be followed by secondary suppuration and destructive septic consequences,

so that it is not altogether a pleasant thing to meddle with; and yet it cannot be left safely alone, if it is enlarging.

TUMORS OF THE NECK.

I would only call attention to one or two little points which seem practical and important.

In the neck there are two regions divided by the sterno-mastoid muscle. All danger in surgery is in front of the sterno-mastoid. The back of the sterno-mastoid is a safe place. Incisions had best be made there. If tumors are situated there, and if they can be removed by cutting through and going directly down on them, or by cutting through and pushing the vessels a little forward, they can be got at more safely than in front. Of course, we should not hesitate to attack them in front; only where we can do so, we should choose the safest point.

The majority of tumors in the neck are glandular; or wens, or enlargements of the thyroid.

GOITRE.

The affection of the thyroid gland which is called true goitre used to be thought, in former times, to be limited to a few districts of the world, and to be due to some obscure cause, like the drinking of snow-water, or being shut up in deep valleys, or changes of temperature; but later investigations show that, although certain valleys of Switzerland are the most frequent places for the production of goitre, yet it is not by any means confined to them. In one portion of England, in Derbyshire, it is quite common, and in this country goitre is certainly common. I am knowing to three cases which originated in Boston. A great many people have one lobe enlarged on one side of the neck, and it

may never grow to any great size. It is a deformity, however, but not a serious obstacle to any of the ordinary pursuits. When, however, the goitre, even though affecting one lobe, becomes larger, it is extremely vascular, and soon becomes a tumor resembling an erectile tumor, or an aneurism. In this form, the changes of menstruation congest enormously the thyroid tumor. All females who have goitre tell you that it swells before the menstrual period and subsides after its flow, just as tumors in the breast do. The thyroid tumor in the male who is in active life, or speaking, enlarges rapidly from distention of the vessels from the constant action of the gland up and down in speaking and swallowing; attains a large size; is covered over by large veins; involves and presses on fibres of the pneumogastric, and interferes with breathing. It makes asthma in a great many persons, persistent asthma; and, of course, sometimes demands interference. Now, interference may be of two kinds, medical or surgical. Medical treatment, in some cases, suffices.

The first use that was made of iodine, which was got from the sea-weeds on the shore, was in its application to the treatment of goitre in Switzerland. Iodine, and the iodides in all forms, combined with potash and iron, are the best modes of treatment of enlargement of the thyroid gland; and, if followed up in large doses, and persistently, they will frequently lead, after months of treatment, to a shrinking of the tumor. These measures failing, if the life of the patient is threatened, we have no resort except to excise the tumor. If of moderate size, it can be done with safety by cutting down carefully and turning it out without opening its capsule. If you can turn it out without opening the capsule you avoid hæmorrhage. It is a blood-tumor, practically

full of dilated and erectile vessels. Keeping the capsule intact and turning it out, the vessels can be tied at the base (the superior and inferior thyroid artery), and the tumor removed with safety.

If the goitre is very large, in some cases it is said to bring on another condition of the patient which is equally distressing, after its removal. The loss of the function of the thyroid gland, whatever it is, produces some trouble in the blood; and an œdema takes place, which occasionally is fatal to the patient in some months or years. The whole subject of the physiological use of the thyroid, and the consequences of removing it, are still somewhat under discussion, and very interesting. We should be cautious about giving too positive a prognosis of being able to cure it; and of curing the patient, also, who is treated by surgical means.

XXVIII.

SURGICAL AFFECTIONS OF THE RECTUM.

VERY many of them, I am happy to say, are curable. They are very frequent also. They constitute a considerable proportion of surgical cases. We see many inflammatory affections come there now which seem to be due largely to civilized habits of life, to sedentary habits, to heating of the parts and to want of exercise, to torpidity of the liver and bowels from over-eating and drinking, etc. However that may be, it is a fact that among civilized people these affections are very common indeed.

It might be useful to treat the matter first from two points of view: first, what we can see externally on superficial examination; and, second, what symptoms are produced in the patient's feelings which might guide us to a diagnosis of the case.

When we look at the external parts in a state of health, they are snugly shrunk in and contracted. The anus, in its normal state, is perfectly closed. Very little mucous membrane appears on the outside, and it is turned in like the mouth of a purse; and it is only by an expulsive effort that the mucous membrane can be seen at all. In conditions of disease we see various things. We find around both sides of the anus, in some subjects, a flat, soft, watery growth, which is œdematous to the touch, changed a little in color, a little paler than the surrounding skin, constantly the seat of a filthy, serous discharge, and infecting the parts with which

it comes in contact and producing excoriation upon the apposed and dependent portions of the body. This is

Condyloma, and is due to syphilis. It is readily curable by sprinkling it with calomel. They frequently get well without internal treatment, but if we add specific internal treatment the syphilitic diathesis can be relieved.

Epithelioma. — On the other hand, we see patients at a certain age, preferably middle-aged or past, with growths about the margin of the anus that look precisely like the warts or vegetations we see in venereal cases on the glans penis, or under the foreskin, or about the vulva in the female. They are fringed growths; hard, as hard as ears of corn; bleed when irritated much; are of very slow formation; whereas the condyloma comes on in a few weeks. This form of growth takes months for its formation. They do not extend by contact, but they extend merely by progressive invasion of the neighboring parts. Not only is the surface of this coxcomb-like excrescence hard itself, and capable of being divided into little heads that bleed on being bruised, but the margins are indurated, and indurated tissue extends around on the neighboring parts. This growth always springs from the junction of the mucous membrane and skin at the edge of the anus as much as outside. On passing the finger into the anus, you find the passage surrounded by this peculiar formation, which destroys to a certain degree the elastic contraction of the sphincter, so that you plunge your finger through the hard mass, which does not give much suction on the finger itself. This is *epithelioma*, the epitheliomatous form of cancer. It is a common site of it. It frequently begins around the margin of the anus, and then begins to protrude outside, and is mistaken for piles. It extends by infiltration. If you examine inside

the rectum, back toward the hollow of the sacrum, you frequently find a lymphatic gland enlarged. This is the first stage of lymphatic infection which is going up the lumbar glands.

External Piles. — On the other hand, we may see, perhaps, a perfectly healthy individual without pain or symptoms about the anus, who has all around the margin of the external orifice minute excrescences which are long and pendulous, and look like altered skin and mucous membrane soldered together and thickened, and which are painless. These are not indurated, not infiltrated, can be drawn out in separate pieces, do not bleed. They are what are called *external piles*. They were originally internal piles. They became pressed down outside the sphincter, and caught so often that they finally staid outside. Their circulation being very much impeded and their vascularity diminished, they harden up by the effusion of plastic tissue and become something between mucous membrane and skin, thick, hard, not sensitive, not vascular, innocent and unchanging from year to year; of no importance except from their appearance, or some slight annoyance to the patient from provoking a little serous discharge from the margin of the anus.

Strangulated Internal Piles. — On the other hand, you may be suddenly called to a patient and find him in great pain; and he will tell you he has something projecting from the anus which was never there before, which has come on suddenly after straining at stool with a constipated passage, or after an attack of diarrhœa with the tenesmus which accompanies it, leading to his forcing down repeatedly the extrusor muscle around the anus. On examination, you find the sphincter firmly closed, and grasping a dark blue, nodular, spherical tumor, excessively sensitive, and of the

size all the way from the end of the little finger to a very large marble, and sometimes larger. It is spherical, non-elastic, not fluctuating, of bluish-red color and intensely painful, and cannot be returned inside the sphincter, which holds it firmly grasped. This is a *strangulated internal pile.* It has become shut down outside, and the sphincter contracted before the mucous membrane had time to retreat. The pile is caught outside. Intense pain ensues. The circulation is cut off, and coagulation of the blood takes place inside the pile, and it becomes the site of a thrombus, and with strangulation constantly coming on by the pinching of the sphincter. It is of sudden occurrence, but not of sudden disappearance, for unless properly treated it will annoy the patient for some days; and finally, if it is cured spontaneously, it will be cured by sloughing off and having the pedicle drop back into the rectum. That occurs, perhaps, after suffering for a week or more, and a spontaneous but dangerous mode of cure is effected, the danger being of septic absorption, and the pain, of course, existing until mortification has fairly set in, when the pain ceases.

Polypus and Prolapse of the Rectum.—Finally, you see two other classes of patients, one extremely rare. You are called to a young child, and you find protruding from the anus a distinct, round, rose-colored, pear-like body, of shape and size not unlike the thumb. On drawing it further down, you find it attached to a pedicle as a pear is attached to its stem. This long pedicle you can trace up inside the anus, and find it is implanted on some part of the bowel. It is a polypus of the rectum. It is an extremely rare thing; and it is rare to catch one down. Generally it is drawn back into the rectum before the sphincter closes, and does not appear; and it is only because it provokes tenesmus

and diarrhœa in the child that the diagnosis can be made, unless you happen to be called in and find it caught on the outside.

In a patient of young age, even in children and in infants — occasionally in adults and quite frequently in old people — you will be called to find a painful condition, where, after straining at stool, the anus is surrounded with a margin of inverted mucous membrane, which is turned out like the lining of a glove, a perfect ring; this is prolapse of the mucous membrane of the rectum. It also is strangulated very speedily. It swells. It secretes at first mucus and serum, then becomes dry and changes color. If it has not been accustomed to being extruded many times it sloughs and dies. This is *prolapse of the rectum.*

So much for what you can see in ordinary cases. All these things are so distinctive that it seems as if you could not fail to recognize them on examination.

Now, as to what the patient feels. Pain in and about the rectum and sacrum, not caused by or coincident with any stool or action of the bowels: this is neuralgia of the rectum, a peculiar affection. Comes in patients of all ages, preferably in those of rheumatic or gouty tendency; is marked by stabbing pains of short duration, precisely like those sharp stabs we sometimes feel between the ribs in intercostal neuralgia. Such pain, recurring at irregular intervals, not provoked by constipation or diarrhœa, and having nothing to do with the time the patient has a stool — this means either neuralgia of the rectum, or, if it is a constant phenomenon going on for weeks and weeks, it should lead to a careful examination of the rectum, when probably some malignant disease will be found, high up, as the cause of the pain.

Fissure of the Rectum. — On the other hand, many persons will tell you that all the pain they have about the rectum immediately follows a passage from the bowels; that they go to have an ordinary passage from the bowels without any anticipation of any particular suffering; that the discharge takes place without any particular suffering or anything noticeable about it; that immediately on the parts returning to their natural state and the sphincter contracting again, intense and wearing pain sets up, which obliges the patient to lie down and remain recumbent an hour or two before he feels able to go about. That is a peculiar form of suffering coming on after a stool, and it is diagnostic of fissure or ulceration of the rectum, especially of fissure of the anus. This is a crack in the mucous membrane. When the sphincter unfolds and the fæcal mass is passed the crack is opened. The moment the fæcal mass is passed and the part closes, the tear, which has been made worse, begins to ache; and it aches a long while until it has got quieted down. No pain before it is stretched; no pain at the moment the fæcal mass is passed, but pain coming on immediately afterwards and lasting a good while. This is characteristic of fissure or ulcer just inside the margin of the internal sphincter.

Those are due sometimes, I think, to tubercle or to prolonged attacks of diarrhœa; and occasionally to dysenteric attacks, though these latter ulcerations usually occur higher up in the large intestine.

Ulcerated Internal Piles. — On the other hand, another person will tell you that he dreads to go to have a passage from the bowels; that he has got, perhaps, into the foolish habit of resisting and deferring, on account of the suffering that he fears; that the suffering is so great, sometimes, at

the moment the fæcal mass is pressing, and he is trying to open the sphincter and have the passage, that nature refuses to allow it to pass. Spasmodic closure takes place for some minutes; just as in inflammation of the urethra, at the neck of the bladder. The patient is unable to have a stool. He rests and waits, and afterwards, perhaps, the stool takes place. It is accompanied from its inception, and during its whole passage and afterwards, by intense pain, burning, agonizing, tearing. It is at its height when the fæcal mass is passing the sphincter, and dies slowly away after the stool is over. If attention is paid to what is passed, it will be found that the passage is not only streaked with blood, but that liquid blood and some clots, perhaps, are poured out in the stool. This is due to internal piles, in what we call the ulcerated state. It means simply that the internal pile, bruised every day by the passage of the fæcal mass, has its surface torn off every time, its vessels re-opened; fresh hæmorrhage takes place, and it is kept sore without, perhaps, postively going through the stage of suppurative ulceration. There may be no pus.

General pains, not connected with the stool, either indicate neuralgia or are due to cancer. Pains following the stool, fissure or ulcer. Pains preceding and accompanying the stool, piles, almost always.

Stricture of the Rectum.—Now, there is another class of cases in which the patient has to make a great effort to have a passage from the bowels; has numerous colics, distention of the abdomen; occasionally is able to extrude a small fæcal mass of tape-like shape; occasionally is relieved by a spontaneous attack of diarrhœa, which comes on, once in two or three weeks, without medicine; provokes, from the efforts of nature to clear the canal, an immense

serous discharge; washes out the entire rectum, and subsequently gives a period of entire relief and rest, until the old struggle begins again. This is due to stricture of the rectum.

The stricture may be of two kinds: may be from syphilis, or what, unfortunately, is much more common, from cancer. If from syphilis, it is more curable than from cancer. Such a condition of the parts can only exist in a particular part of the rectum to produce these symptoms. In other words, if there is an obstruction down near the margin of the anus, it does not produce these symptoms; but the painful symptoms of true stricture are produced when the real obstruction is high up, in that part of the bowel which is not firmly attached about the outlet to the pelvis; where it is free and loose, and where cancerous or syphilitic deposits taking place, make a firm, contracted ring about the bowel.

What takes place? The bowel becomes invaginated through this little artificial ring, or sphincter, over and over again, in the efforts to produce a stool. Such invagination cannot take place lower down. If there is a stool pressing to come through, it will take all the room there is; and unless there is so large a growth as to block up the passage, it will not lead to symptoms of real obstruction. On the other hand, syphilitic or cancerous deposits high up in the bowel, in the form of annular constriction, with the bowel pressing from above, produce a true invagination of the fold of bowel above. Nothing can pass. Spasm takes place, obstruction, accumulation of gas; and by and by the invagination perhaps relaxes. A little mass passes through; and is finally passed in a minute tape-like or thread-like form through the anus. By and by, nature is provoked to an immense effort. A great serous discharge takes place

throughout the intestine. Everything is washed out; diarrhœa occurs, and the patient is relieved.

Imperforate Anus. — The new-born baby may appear to be all right for the first twelve to twenty-four hours. It may be noticed, however, that there is no staining of meconium which comes from the intestinal canal. Unless it is carefully examined no imperfection may be discovered. Within twelve to twenty-four hours after birth the little child, although it has relieved itself by passing water, begins to have a swollen stomach, regurgitation of gas by the mouth, colic, and straining efforts to pass something by the bowel; and, on examination, it is found that there is no opening to the rectum; that the anus is imperforate. This imperfection may exist in various degrees. It may be so slight as to be a web across the anus. In the female child the bulging and straining out of the perineum, in efforts at defecation, is extremely deceptive; for it will be found, frequently, in the female child, that, whereas we supposed there was a web over the anus, that is is due partly to protrusion of the vaginal walls; and the bowel is cut off an inch or two up, and no exit exists. The child, if unrelieved, lives a few days, and dies in misery.

This is a brief *résumé* of the appearances and symptoms produced by diseases of the rectum. We will take up appearances first.

Hæmorrhoids. — They are always due to distention of the hæmorrhoidal veins. The hæmorrhoidal veins are very numerous; have direct connection with the veins of the liver. They are very easily congested. They bulge out and swell inside the anus. They are inflamed by the passage of the fæces. They frequently become the seat of thrombi, or clots, inside the rectum; and become temporarily occluded in that way. They occasionally burst open, tear open and bleed

during a passage from the bowels; and frequently bleed to a considerable degree after the passage has taken place. Some idea of their situation and size may be formed by the hæmorrhage which takes place, though we cannot always judge. Sometimes patients will have three or four violent bleedings, several days in succession; then, just as happens in other parts of the body where considerable loss of blood takes place, the vessels shrink and everything is quiescent a few weeks, when the trouble begins over again. Unless the patient is one of intelligence and accustomed to analyze his sensations and to look carefully at the condition of the passages from the bowels, he often does not know he has lost blood at all; and, at any rate, he is almost always unconscious of the amount he has lost. If he goes and sits on the seat of the ordinary water-closet and has a passage accompanied with a little blood, it is all washed away, and he perhaps does not realize how much he has lost. If in these cases the physician has an opportunity of inspecting a number of the stools passed, he gets a good deal of information. You will frequently find the passage dotted over with a half-dozen little clots firmly adherent to the fæcal mass. It is like a cast taken from the inside of the bowels; shows the mouths of four or five bleeding vessels which have bled during the passage. If, on the other hand, the blood is entirely liquid, you may infer that some vein has ruptured which is still bleeding inside the bowel; and the next stool will be preceded by a clot, followed by a fæcal mass. In that way you may make a pretty accurate diagnosis of what is going on.

The trouble about this hæmorrhage from the bowels is, not that it is of any consequence each time that it occurs, but the fact that it is a constant leak, and especially in patients who have passed their youth and are approaching middle

life, that it gradually becomes a source of permanent anæmia, which they are unable to recover from; and they become more and more bloodless as time goes on.

All sorts of sensations are produced by this condition; buzzing in the ears, occasional attacks of dizziness, faintness, imperfect action of the heart, restlessness, imperfect sleep; and all due to this anæmia produced merely from the continuous loss of blood from piles. I must caution you that these occur perhaps more often in females than in males; and that the symptoms of anæmia produced by hæmorrhage, and the symptoms of suffering produced by piles, in the female are frequently mistaken for uterine troubles, mimicking them, so to speak; the real trouble being overlooked, because no examination of the rectum is made.

When we pass the finger into the rectum in a case of suspected piles, we can generally feel them. We are conscious that the finger is not passing over a perfectly smooth mucous membrane. They are not hard. They efface themselves, so to speak, under the finger. They are almost always just inside the external sphincter. If they become forced down and become external piles, they are practically cured; harmless; cease to be vascular; cease to be painful; and are merely an unsightly projection.

It is important to treat this affection promptly; and it, as a rule, can be cured with safety, sometimes by medicine alone. The careful regulation of the diet; avoidance of some substances which are irritating to the rectum, as, for example, strong condiments; avoidance of food which contains many seeds, as the seeds of certain fruits or vegetables; care being taken to have a diet which will be perfectly smooth and easy; the use of a good deal of olive oil with the food in the form of salads, which are extremely useful in these affections of

the rectum; black pepper; a confection of pepper of the pharmacopœia was quite a favorite old-fashioned remedy for piles. You may give that, or give an abundance of black pepper upon the food in the same way. Great care with regard to the passages from the bowels. They should be once a day, and be soft; neither diarrhœa nor constipation. The best class of agents to produce these are those which contain sulphur, bitartrate of potash and senna; sometimes jalap is added. In that way a mixture may be made up which is cooling to the parts and produces a gentle passage once a day. Drugs containing aloes are injurious. They make a great straining of the muscular coat of the rectum, and produce violent efforts at dejection and irritate the parts. I would warn you that perhaps ninety-nine out of one hundred of the proprietary pills which are sold to move the bowels contain aloes, or aloin, which is the common ingredient in every cathartic pill which is sold. It is directly injurious to the rectum where there is any tendency to irritation of it.

Local applications may sometimes cure these piles. The application of a suppository containing especially stramonium and gallic acid or tannin is about as useful as anything; may be applied in form of a suppository or salve; may be used with the rectum repositor. This will place in the rectum any substance you place in the barrel. It is a very useful little instrument.

These means failing, we have to resort to surgery. In old times piles were always ligatured. Now they are either ligatured or burnt off. Either method is good. The old method of operating for piles by the ligature was somewhat dangerous to the patient, and also very painful. They suffered, and they had a good deal of risk. That operation consisted in the patient's making an effort to strain down. The physi-

cian then seized the pile and drew it outside the sphincter. The pile was then tied, and an effort was made to restore the whole thing back through the sphincter. Sometimes this succeeded and sometimes it did not. Result: pressure of the sphincter on these inflamed surfaces; terrible suffering; dirty discharge; sloughing of the pile; and some chance of septic absorption, or a pelvic abscess.

Nowadays the operation consists in stretching the sphincter thoroughly; then the piles are easily extruded into view; then they are dissected away from the junction of the skin and mucous membrane all around, so that they remain attached by their bases only to the mucous membrane. This can be done with very little hæmorrhage, because the vessels are parallel between the mucous membrane and skin. After they are dissected away and the lining of the rectum lies out as a partially dissected mass, take each pile separately, nick around the mucous membrane on the inside, tie the small pedicle which remains, which contains all the vessels, firmly with a strong ligature, and then we, as a rule, either score the pile and let out the thrombus, or cut off a portion of it, perhaps one-half inch; repeat this on every pile; then push the parts back into place. They will not stay; consequently, we pack the rectum with a piece of cheese-cloth or gauze, oiled with carbolic oil, and filled with minute carbolized sponges; then a small sponge and T-bandage on the outside. No suffering follows this operation, because the ligature is cutting only on the vessels. The tension of the bowel has been let off by scoring the surface or cutting off the pile. The pinch of the sphincter has been destroyed by stretching it so that it does not press upon the parts. The only inconvenience the patient suffers, as a rule, is stoppage of the water, which is due to the fact

that you have packed the rectum so full of sponges that they press upon the membranous urethra in the male, and he is unable to urinate for twelve to twenty-four hours, and has to have a catheter passed once or twice. The first packing should be taken out within twenty-four hours; the rectum washed with a two-per-cent. boracic solution and repacked much more gently than before; the second packing being only to press softly upon the parts. At the end of four or five days the pile and the ligature come away. Then there is left a period of quite protracted convalescence. This is the dangerous period. You have left a granulating base to every pile, so that the margin of the anus is dotted over with ulcers which have got to heal by second intention. In order to get a good result, the patient should be kept strictly in bed; the parts gently packed and dressed every day. The patient should be fed on oleaginous food, and an easy state of the bowels kept up; and if that is not sufficient, the best possible cathartic is castor oil. It is not necessary to give large doses. A drachm, repeated, will frequently do all that is necessary. A drachm of castor oil twice in twenty-four hours will frequently suffice. That does not provoke any trouble in the stomach, and it is a good emollient for the parts.

As soon as the strings have separated and the piles have come away, you had better give castor oil, and have the rectum cleared; and keep it up gently, every day or every second day, until healing takes place.

The operation by clamping and burning is done by stretching the sphincter, drawing the pile out to the surface, and clamping. One side of the clamp must be of bone or ivory, in order that the bowel may not be burnt. You must be very careful to have a good clamp which is protected by horn or

bone or ivory on one side, and steel upon the other, the steel part being on the outside and the pile being squeezed up through it. After the clamp is firmly on, then the galvano-cautery is carefully applied to the pile, sawing it across, burning and scoring. Then the clamp is relaxed a little. If a bleeding point occurs, the cautery is touched on again, etc., until the pile is destroyed. This is a clean way of treating piles. The subsequent treatment is the same as above described.

Fissure of the rectum is cured by stretching the sphincter usually, not always. Sometimes a little more is necessary. In the old crack it is not sufficient always to stretch the sphincter. It is better to stretch the sphincter first and then score the fissure, evenly and thoroughly, with a sharp knife, down to the mucous coat, so that you make a fresh cut; and that generally heals promptly.

Prolapse of the rectum is best treated by constant restoration of the parts by the hand every time it occurs, the patient, if old enough, being able to do it himself. In the young child, the mother or physician has to do it. The parts must be nicely oiled, the hand oiled, the protruding mass grasped and gradually squeezed back into the anus, precisely as you would reduce a hernia. It goes back, in the fresh case, with a distinct snap. In old cases it goes back slowly and indolently, and tends to protrude again. A piece of cotton-wool then passed up, dry, into the rectum is extremely useful to hold the parts in place. Many people with slight prolapse are enabled to get about comfortably in that way. If they feel the prolapse taking place, they have conveniences at hand for oiling the parts, and then they tuck up into the rectum a good lump of dry cotton and leave it there. This will stay dry for a good many hours, and holds

the parts. The young child can be cured, and some adults may be much relieved, by an artificial apparatus to hold the prolapsed mucous membrane up in place. This affection, in several dispensary cases I had several years ago, I cured by this sort of apparatus. It is an ordinary truss spring; the pad of the truss presses up on the anus, following the curve of the sacrum and coccyx. Now, here comes a very practical and simple point. Such a plug held up against the anus all the time is very painful, if solid, because it resists the attempt to pass any wind from the bowel, so that this should be made with a circular pad, and with an orifice large enough to admit a pencil in the centre. In this way air can pass through the anus, and the patient is perfectly comfortable. In this way children can be cured. As they grow up the bowel recovers its elasticity, and they get well. Adults cannot be cured in this way; but they can be made extremely comfortable by this form of apparatus. Now, the patient can wear one of these trusses while he goes about. When he sits down he can take it off; and when he wants to walk again, he can reapply this apparatus. If the pad is made of hard rubber it can be kept perfectly clean. In the early case and young subject, it is probably safe to try to cure a prolapse of the rectum by destroying the part, either with the hot iron or ligature. In the adult, or old person, it is a dangerous operation; and other means had better be resorted to.

Cancer of the Rectum, as I have said, only produces symptoms of absolute obstruction when it is high up. It is only properly capable of surgical treatment when below the fold of peritoneum on the rectum; and when it is free and movable, and no glands are involved. What is the use of removing cancer of the rectum and leaving a cancerous

gland in the hollow of the sacrum? Such an operation can give only a few weeks of respite to the progress of the disease at the expense of great suffering. All authorities formerly agreed that it was improper to open the peritoneum in removing the disease; and the fold of peritoneum is somewhat different in different individuals as to the depth it descends. Modern operators claim to disregard the peritoneum in high excisions.

There are several ways of operating. One is by curetting and burning. That is not satisfactory. It does pretty well with the large ulcerated, epitheliomatous growths near the anus, where the obstruction is only due to mechanical obstruction. The other form of operation is to excise the lower end of the rectum. When the disease is low enough down, this can be done with safety and advantage. The patient subsequently has lost, of course, the sphincter; but in the upper muscular wall, the circular fibres act pretty well afterwards. The patient is able to retain solid fæces always; to retain liquid fæces and gas, scarcely at all. The gas escapes frequently to his annoyance. Fæcal matter does not escape unless he happens to have liquid fæces in the bowel; and by care about the diet, and the occasional use of opium, he gets along pretty well. The pain after excising cancer of the rectum is almost nothing. The parts heal up well generally; and on the whole it is a pretty good sort of operation; but as to the results which it produces in curing the disease, they are of course no better than they are in operations for cancer in other parts of the body. In a number of cases in which I have kept the records pretty carefully, the results justify me in saying that excision of cancer of the rectum will give entire respite and comfort to the patients; enable them to resume their habits for four to six months; and after

six months, recurrence is very apt to take place higher up. Perhaps I should allude to the high excision of the rectum, done by sawing the sacrum.

If we do not operate, a great deal can be done in cancer of the rectum by care of the diet; by internal use of daily doses of castor oil; for fæcal obstruction is one of the great causes of suffering in these patients; and also by the judicous use of opium. Now, this is such an important point I must say a word about it. Several years ago I had a patient with cancer of the rectum far up out of reach. Operative treatment was out of the question. The patient lived a year under my care. It was a month or two before I was obliged to pass beyond ten drops of laudanum in the rectum to relieve the pain. Begin with the smallest possible dose, and creep up as slowly as possible, in order to save for the patient the power of the drug, for the last hours of suffering, which are sure to come. In the case alluded to the dose was slowly increased until it reached one and a half or two grains of morphia a day. *Per contra*, I have had a case in which morphia had been given indiscriminately. The patient had not had the disease long. Long months of misery were before the patient; but the small dose was wholly inadequate, and one to two grains of morphia were necessary to start off with, to do anything at all. When you get to these enormous doses, unfortunately, the comfort does not increase in the ratio of the dose; and the patient does not get along so well as if he had begun with extremely small doses.

Fistula in Ano. — There are two kinds, the external and the internal. The external fistula is ischio-rectal abscess marked by a little sinus near the anus. The internal fistula arises from ulceration in the rectum, frequently tubercular. The rectum gives way. A little pocket forms in it. A little

septic fluid and fæcal mass accumulate in it; gradually this pushes out into the tissues until it makes an abscess. The abscess may break on the outside, and then we have a complete fistula. On the other hand, ischio-rectal abscess may form on the buttock and break into the rectum, and then we have a complete fistula. Those are simple cases of complete fistula; but the blind or internal fistula means ulceration of the rectum with formation of a pocket, which never suppurates and breaks through on the outside. After it is filled, it discharges itself into the rectum. There is a hard, shot-like pouch near the anus, which varies in size. After it has been large and painful, we next notice a little staining and disagreeable discharge coming from the anus and soiling the clothing; and this is found to be pus mixed with fæcal matter. The little sac has become distended, and discharges itself into the rectum; to be again filled and reopen. There is no difficulty in discriminating external fistula. The difficulty always is in finding the internal opening; and the whole secret of success consists in getting a probe through the internal opening before you lay open the fistula. If you make a false opening, a renewed abscess will form in the tissues when the scar is healed, and the operation will have to be done over again. The internal opening is always inside the sphincter, not far up the bowel. It may be tortuous; but it is always down near the anus. That being once found, the fistula is laid open and packed, and forced to heal from the bottom; the essential treatment being that it should be packed every day, and not allowed to bridge over, so that a sinus may possibly form at the bottom of the ulcer. If you cannot find the internal opening, you can usually detect it by putting in a speculum and injecting the fistula with some colored fluid. If there is an opening in the bowel, it will

run through and show itself inside the anus. Moreover, the surgeon who examines for fistula in ano, after seeing the external opening, passes his finger within the anus, and finds, almost always, inside the anus, near the sphincter, a papilla. That means the internal opening.

The only curative treatment, in either form, is to have the opening made free through the bowel; divide the sphincter perfectly, and force the cut to heal from the bottom.

There is one other treatment of piles, the injection of carbolic acid. It may be done by the subcutaneous syringe. The parts should be thoroughly protruded in sight, a pile selected, and a little of a solution of carbolic acid thrown in. About one minim of pure acid may be thrown in, with twenty minims of water. A portion may be thrown into one pile and a portion into another; care being taken to get into the piles and not into the cellular tissue around the pile. If you get into the pile, the immediate result is a thrombosis, hardening, shrinking, and frequently cure. I would caution you that a very small amount must be thrown in; that it should be thrown only into the pile; and the injection should not be repeated oftener than once in ten days to two weeks. The part must have time to recover; otherwise you are in danger of provoking cellulitis and abscess.

XXIX.

HERNIA.

By hernia is meant that some portion of the contents of the abdominal cavity, either the omentum or the bowel, escapes through an opening left by nature.

There are two principal kinds of hernia. One set of these protusions takes place through the canal and abdominal rings which are left after the descent of the testis, and are afterwards imperfectly closed. These were intended for the passage of the cord and spermatic vessels. The other class takes place in the groin; is sometimes called femoral hernia or crural hernia; and takes place through the slight opening which exists between the femoral vein and Gimbernat's ligament. This opening was left, probably, for two purposes: one for the passage of the lymphatics, and the other to allow of a certain amount of distention and change in the contents of the large vein, where it is constricted. In passing over the pubes, the vessels are held down firmly by Poupart's ligament, and constricted, on the other side, by the sharp edge of the ligament reflected on the pubes, which is called Gimbernat's ligament.

It is evident from consideration of the skeleton that the latter form of hernia is more likely to take place in the female than the male; for although the crural or femoral opening, so called, exists in both sexes, yet it is likely to be larger in the female than the male on account of the greater width and spread of the pelvic bones. Inasmuch as the pelvis of the

female is almost always wider, consequently the space between the anterior spine of the ilium and pubes is usually longer. The space included under Poupart's ligament is larger; a greater amount of space is left for the vessels, and the crural ring is proportionately more open. There is, however, in an absolute point of view, no distinction of sex between these classes of herniæ, because the crural kind occurs in the male as well as in the female. In the female, also, there is a species of inguinal canal, called the canal of Nuck, which transmits the round ligament of the uterus. Although it is not nearly so large or patent as in the male, yet it is a deficiency and a weakness in the abdominal wall; and it is a site of hernia.

In the male, the testis, in the fœtal state, lying near the canal, gradually descends; is guided in its descent by a set of muscular fibres; draws after itself the cord and vessels; finally reaches the scrotum; and the peritoneal pouch which was carried down with it is generally shrunk up, shrivelled and drawn back. The cord only remains; and the inguinal ring is practically a closed opening so far as the peritoneal cavity is concerned.

Now this diagram will show that in the descent of the testis such a perfect condition may be represented, as here. Here we have what is supposed to be the external abdominal ring. Here, the tunica vaginalis with the testis inside. Here, the cord. This fold is the peritoneum pinched off. This is the perfectly normal state. Entire failure of this closure may take place; and the child may be born with a patent tunica vaginalis which runs up directly into the abdominal cavity. Various degrees of imperfection may also occur, as are shown here.

The variety where the abdominal cavity and tunica vagi-

nalis are one may give rise to two conditions of weakness; one is a congenital hydrocele, where the fluid secreted in the peritoneal cavity has no obstacle to prevent it from gravitating down into the tunica vaginalis; and we have a hydrocele which communicates with the general peritoneal cavity. In the ordinary congenital hydrocele, the cavity of the tunica vaginalis communicates with the peritoneum only by a small aperture, through which the fluid trickles slowly. The other infirmity, which may arise just as readily, is that a fold of bowel or omentum, or both, may drop down in the fluid; distend this little opening still more, and eventually fill the tunica vaginalis. And this bowel or omentum is not in any sac of its own, but must lie in contact with the testicle. This is congenital hernia. The infant is born in this condition. The fluid lies there most of the time. When the child cries, the bowel and omentum are forced down. It is readily replaced in the abdominal cavity when the child lies down. It returns the moment the child is upright. When it is bowel and omentum the return is with a gush. When it is fluid only that comes down, you see the sac slowly filling and becoming distended. In the one case, of congenital hernia, rapid protrusion when the child stands up; in the other case, slow filling of the sac from the fluid trickling down from above. This is quite sufficient sometimes to enable us to establish the diagnosis between congenital hernia and congenital hydrocele. Hydrocele of the cord is represented by these two imperfections upon the cord itself. They have nothing to do with hernia. They annoy the patient and afford difficult problems to diagnosticate. A harmless operation with aspiration will settle the diagnosis. If it is hydrocele, we draw off the fluid. If it is hernia, we do no positive harm in punct-

uring; and can make a diagnosis. So much as regards inguinal hernia, as to the peculiar conditions under which it occurs.

In the perfect individual it must occur as a tear and sudden strain. In the person of lax habit it occurs slowly and insidiously, as the child or person develops, without any particular strain. In other cases, where there is an imperfect shrinking of the sac high up, it forms a double fold over the hernia, as it comes down.

No such condition governs the occurrence of femoral hernia, which is due, apparently, to this little opening remaining patent; it may occur in either sex, but is more common in the female. Inguinal hernia is far less dangerous than femoral; less apt to be strangulated suddenly than femoral; because the coverings and canal through which it descends are distensible and soft; whereas the opening of the crural hernia has bone on the one side and a sharp membrane on the other, which speedily pinches, bruises and injures the circulation of the hernia which has passed through it.

A good deal of the obscurity in describing hernia anatomically is due to defective nomenclature. We speak of the external and internal abdominal rings. The external abdominal ring, however, is the central one as regards the body, and is towards the pubes. The internal is the outer one, towards the ilium. That sometimes gives rise to confusion. We mean external and internal with reference to the plane of the abdominal muscles. A still greater obscurity seems to be due to the name of the pillars called the upper and lower, or external and internal, pillars of the abdominal ring. Another error is in considering the opening a ring at all, for it is not a ring, but a slit or fray of the tendon of the ex-

ternal oblique muscle, across which have been thrown certain staying bands, or fibres, to prevent the rip from extending farther up. In proof of this is the fact that in old people a peculiar form of inguinal hernia occurs, in which, on account of laxity of the walls and weakness of the fibrous tissue, the external abdominal ring becomes converted again into a long, triangular split; and in these cases, in old and feeble individuals, you will sometimes find a hernia, which, on being reduced, leaves an opening into which you can pass four fingers side by side.

Now we will run over briefly the anatomy of inguinal hernia and of femoral hernia, because that throws a good deal of light upon certain conditions. I wish to say, first of all, that however important it may be to bear in mind certain cardinal distinctions of anatomy, it is not important that the surgeon should recognize every layer in cutting down upon a strangulated hernia, and practically it is never done; but inasmuch as the disposition of the fascia and vessels makes all the difference in the direction in which taxis should be applied, and in which the knife should cut, it is important that we should have in our minds a pretty distinct idea of the original anatomical arrangement. You will bear in mind that in hernia these things become very much changed by the diseased condition. They become stretched and altered and thickened and somewhat displaced; although the cardinal directions of different points from each other are never practically altered, however much they may seem to be. In an old inguinal hernia the inguinal canal becomes very much shortened. The two rings approximate each other. The internal ring is forced down until it lies near the external ring; and it is sometimes hard to distinguish, at first, between the form called direct and that which is called

oblique. We will first uncover the canal to see the layers that cover it over in the normal state.

Anatomical Description. — The hernia first pushes before itself a pouch of the peritoneum, then enters the transversalis fascia and descends the canal, where it is covered by the cremaster muscle; then it comes down to the vicinity of the external ring and pushes and distends the spermatic fascia; and, having pushed through this, it comes to the superficial fascia, and, finally, to the skin. We have, in all, six coatings. That is oblique inguinal hernia. It follows the course of the testis. Its coverings are the coverings of the inguinal canal, and the tissues in it; among the most notable of which are the transversalis fascia, the cremaster muscle, and the fibres of the spermatic fascia, which overlie the ring, and prevent its fraying out.

Now, on the other hand, there is an occasional form of hernia which is called direct, in which the rupture comes down to the external abdominal ring without having anything whatever to do with the internal abdominal ring. Such a rupture starts opposite the external abdominal ring. It has to push the peritoneum before itself, the transversalis fascia, then emerges at this tendon, which it splits and passes through. This is the conjoined tendon of the internal oblique and the transversalis muscle. Then it emerges at the ring. Then it has the spermatic fascia, superficial fascia and skin. The direct inguinal hernia is distinct, as regards its coverings, from oblique only in the fact, that instead of the cremaster muscle it has the conjoined tendon as one of the obstacles through which it emerges. In the old oblique hernia when the sac has been pulled down a good deal, the two rings become opposite each other, and it is difficult to say at first whether we have to deal with direct

or oblique hernia. The position of the vessels is different, which is the only important point. You will see at once that if a hernia emerges at the internal ring, it starts to the outer side of the epigastric vessels; and if it emerges at the external ring, it starts to the inner side.

There is a peculiar fœtal relic which seems to divide the peritoneal pouch into two distinct portions, one of which lies opposite to the internal abdominal ring, and the other to the external ring. It is represented here diagrammatically. It is intended to mark the course of the obliterated hypogastric vessels. After the fœtal state they become a mere fibrous cord. They lie upon the inner folds of the peritoneum. They are shorter and less distensible than the peritoneum, and practically form a distinct barrier which pouches the peritoneum, one pouch being opposite the external abdominal ring, one pouch opposite the internal ring. It is claimed by some that, according as one or the other pouch happens to be the weaker and more distended, the hernia is direct or oblique. Oblique inguinal hernia necessarily has all the coverings of the cord. If it has to be pushed back into the abdominal cavity, it has to be pushed back in the direction of the inguinal canal, which is upwards and outwards. Inguinal hernia of the direct variety comes straight out through the external abdominal ring; does not have all the coverings of the cord. If it is to be restored, it has to be pushed directly back, and not up through the inguinal canal.

Direct inguinal hernia must always be of the variety called rupture, because there can be no weakness there in the beginning. There never was an opening through the conjoined tendon at the external abdominal ring, naturally; and therefore direct inguinal hernia occurs, as a rule, in strong

and muscular subjects; sometimes in men who have been strong and muscular, and are getting older and becoming fat and a little lax; and in them, after the occurrence of heavy lifting or something of that kind, the intestine is pushed out through the external abdominal ring, forming a direct hernia, pushing aside the fibres of the conjoined tendon, and having no relation to the inguinal canal.

We cannot expect, in practical life, when called suddenly to a patient with hernia, to call to mind instantly all these details. It is very desirable that we should have learned them once; and that they should have become, so to speak, so engraved and familiar, that they have left an impression which makes it clear to our minds, that there are certain broad distinctions to be looked out for. These are the distinctions between direct and oblique inguinal hernia; the relative positions of the vessels, rather more than the coverings themselves.

Now we come to a much more important distinction; and that is, in the first place, how we are going to tell; and, in the next place, what is the consequence whether we tell or not, between the hernia which is inguinal or crural; one emerging through the external abdominal ring, the other through the crural, or femoral ring? We should have in our mind the question of sex: if female, a crural hernia; but not necessarily. It is then important to distinguish between the two varieties for these reasons, that the position of the vessels and the direction of the canal, if you choose to call it a canal, of crural hernia is so different from the inguinal variety; the course which the bowel pursues in coming out is so different in its direction from the inguinal variety, that any efforts to replace the bowel must be conducted by taxis, used in an entirely different direction; in two different

directions from that used in the inguinal variety. Moreover, when it comes to a question of strangulation, if we have not accurately distinguished between oblique and crural hernia, and have not that distinction firmly fixed, we do not know where to cut to relieve the stricture. The question is, where to cut with safety with reference to the position of the vessels; for the vessels bear an entirely different relation to the crural opening from what they do to the inguinal.

In the inguinal variety, in order to avoid the vessels, we cut directly upwards, because the bowel is to the outer side, or the inner side, of the vessels; and in cutting directly upwards, we cut parallel to the vessels themselves. On the other hand, in the crural opening, the large vessel lies on the outer side; and the safe cut and the necessary cut is not to cut upwards, but inwards towards the spine of the pubis; and to divide Gimbernat's ligament, away from the femoral vein; that being, in fact, the ligament which is constricting the bowel, and producing the strangulation.

That is the importance of knowing the distinction between the two. How can we tell at once which variety we have to deal with? Simply by observing and studying the external abdominal ring. Every form of inguinal hernia has got to emerge, sooner or later, through the external abdominal ring. No form of crural hernia has anything whatever to do with the external abdominal ring. Both in the male and female the external abdominal ring should be readily found by finding the spine of the pubis, and above, and to the outer side of that, is the external abdominal ring. In the male you can easily diagnosticate it by pushing a fold of the scrotum up into the ring on the finger, and finding whether it is empty, or filled by some foreign substance. In the female we can invaginate to a certain degree, the labium;

and almost always make out whether the external abdominal ring is empty or not. If empty, it is not inguinal hernia. If full, it cannot be a crural hernia, unless the patient should have two forms at the same time; but that would be so improbable that we need not consider it. Abdominal ring and the spine of the pubis the first guide. Abdominal ring to be found and explored with the finger. If occupied by foreign substance, some form of inguinal hernia. If empty, necessarily crural hernia.

We will briefly outline the coverings of crural hernia.

Anatomical Demonstration. — The course of crural hernia, in coming out, is downwards on the sheath of the vessels, then forwards and inwards, then upwards; and if it continues long enough, as it cannot descend the thigh, it slowly begins to curl up towards the abdomen, so that the fundus may lie up toward the abdominal walls, and appear to cover entirely the abdominal rings, and to be largely above Poupart's ligament.

The coverings are: skin, superficial fascia and cribriform fascia, fascia propria, peritoneum. The course is first through the peritoneum; then distending the sheath of the vessels downwards, forwards, upwards. Taxis then has got to be made downwards, backwards, upwards towards the centre of the body; whereas in inguinal hernia it has got to be made directly backwards; or upwards and outwards. In femoral hernia it has got to be pushed down, back and up in order to get it within the abdominal cavity.

The important points with reference to these distinctions are in the one case with regard to taxis, and in the other case in regard to diagnosis, to indicate the way we have to operate between the inguinal hernia and crural. The distinction between direct inguinal and oblique inguinal is not of nearly

so much consequence as the distinction between any form of inguinal hernia and the crural variety; and the distinction can be made by finding the spine of the pubis, the external abdominal ring, and finding out whether this is occupied by some foreign substance, or is empty. If it is full, it is a form of inguinal hernia. If it is empty, it is a crural hernia; and although crural hernia is much more frequent in the female, still it may exist in the male, and not very uncommonly does.

Now you can see from the direction of this; from the small size of the opening; from the inelasticity of the boundaries, how soon violent symptoms must be produced by a knuckle of intestine which gets pushed through, wedged in between the walls of the vessels, pressing against the sharp edge of Gimbernat's ligament above and the bone below. Such a hernia does not become very large, as a rule.

As crural hernia is down in the fold of the groin, and inasmuch as the fold of the groin is not usually observed and is frequently occupied by other substances, as enlarged lymphatic glands; as it is of slow formation; comes out a little, retreats, comes out a little, retreats, it is frequently unnoticed. Whereas the inguinal hernia is directly out in the air, so to speak, from the first time it is formed; distends the abdominal wall; gives rise to a sense of weakness in walking and coughing; soon creeps down until it approaches the external abdominal ring; and once in the scrotum it alters the shape of the scrotum, and can hardly fail to attract attention. In addition to this, crural hernia being more frequent in the female, the female is more reluctant to speak, and have the trouble, in that region, investigated. She is more apt to consider that anything that is the matter there may be a very little thing; should be borne, if it is not very painful, for a

little while; hesitates before having any exposure or examination; thinks perhaps it will go away, as perhaps an enlarged gland has gone away before. In that way, the stages of crural hernia are overlooked; either unnoticed, or not explored, until finally some serious change takes place; and that change always takes place in the shape of a sudden strangulation. Once that has occurred, then the symptoms of a crural hernia are more rapid and intense and more positive than those of the inguinal variety. There is never any possibility of a large distention of the opening. Such a thing as an enormous crural hernia is practically unknown; whereas in the abdominal region, the external ring may be slit up and frayed for a long distance, and large herniæ may escape, and three or four fingers may pass into the opening. Such a hernia can hardly become strangulated by the opening itself. It may become strangulated in the scrotum by twists, or by adhesions. Such, however, is not the fact with the crural hernia. This is very readily strangulated; speedily gives rise to acute symptoms; and is more frequently fatal than the other variety.

XXX.

HERNIA.

The ordinary forms of hernia are the oblique inguinal, direct inguinal, and the crural or femoral. A not uncommon form is the umbilical. This occurs in infancy from non-closure of the orifice through which the umbilical cord emerges. It occurs later in life, preferably in females, through the laxness and separation of the recti muscles during pregnancy. What is called umbilical hernia does not by any means always come through the umbilicus. In dissecting in the sheath of the rectus we see numerous orifices for the passage of vessels and nerves; and through some of these a small hernia occasionally takes place, which resembles umbilical hernia; which is smaller, and above, below or to the side of the navel.

The ventral hernia is the result of an injury, and usually of a cut or stab, sometimes of a surgical operation. Nowadays, when the abdomen is opened so frequently, ventral herniæ are quite common as the consequences of laparotomies, whether for the removal of tumors, or for the seeking of abscesses. These are the principal forms of hernia. There are some other forms which are very rare. There is, for instance, hernia into the vagina, into the obturator foramen, etc.; but they are not frequent enough to demand much attention.

The condition in which the herniæ are themselves is an important point. When one of the natural orifices, like the

inguinal canal and external abdominal ring, has been dilated by the passage of a hernia, and the patient has had the complaint for some time, the rupture comes down while he is standing upright and frequently returns of itself when he goes to bed. He, also, can frequently replace it himself much better than the surgeon can do. This form of hernia is called reducible. In the older class of patients, and in patients who have injudiciously worn a truss when the hernia was partly down, although they thought it was back, there are sometimes adhesions to the omentum, or bowel. They are connected through the sac to the scrotum, to the tunica vaginalis, or to some part outside of the abdominal cavity. The result is that such a hernia becomes irreducible, or incapable of being returned into the abdominal cavity. Almost always a certain portion of it can be readily pressed back, but not the whole. The patient frequently wears his truss over a little bunch of omentum, thinking the whole hernia has been reduced. These irreducible herniæ are also very common in the crural canal, where adhesions readily take place, and where a little bit of omentum frequently will stay down unnoticed, being mistaken for an inguinal gland.

The herniæ that are easily reducible, and even of large size, occasionally get impacted, as it were, in the sac outside the abdomen; and although capable still of reduction, they become, what is called in technical language, incarcerated herniæ. They are distended with gas, or perhaps twisted about under folds of omentum. Gas distends the bowel, and a portion of omentum falling, perhaps, blocks the opening. The gas is held in the sac; and while it is there the hernia cannot collapse sufficiently to go back. Such a hernia is caught down; not necessarily irreducible;

but for the time being in a condition that it cannot be put back. It becomes painful to the patient. If not put back, it becomes inflamed; and then, of course, speedily the reducible hernia becomes irreducible from the rapid formation of fibrous and serous adhesions, even if nothing worse takes place. This is the consequence of letting an incarcerated hernia alone, and not trying to reduce it.

Finally, we have the condition of hernia called strangulated; that is to say, it is so far affected in some portion of its circulation, that peristalsis is stopped in the alimentary canal, and graver symptoms arise. It is not necessary that the entire calibre of the intestine should be pinched in order to give rise to the symptoms of strangulation; for a portion of the edge may be caught under Gimbernat's ligament, in such a way as to arrest peristaltic action, and then the symptoms of strangulation come on. Of course, symptoms of strangulation come on much more slowly in the strangulated omentum than in the strangulated bowel. Some herniæ may be wholly made up of omentum; and the patient may have very little trouble with that for a long while. Finally, they get caught down and strangulated; but the symptoms in that case are deceptive, and go on slowly. At last, when the bowel is involved, either by being pinched itself through the whole or a portion of its calibre; or folded in and turned over and compressed by omentum, at the ring, in such a way as to have its peristaltic action interfered with, then the symptoms become very marked.

A hernia is diagnosticated principally by the fact that it comes down when the patient stands up, and gives an impulse on coughing. Its location, of course, must be, in the ordinary forms, opposite one of the natural apertures; and it is usually rounded and soft in feel; elastic to the touch;

and gives a very decided thrill and impulse when the patient is told to make repeated efforts in coughing; this latter is quite unmistakable. A psoas abscess, which comes down outside the crural ring, under the crural arch, also gives a thrill, which may be mistaken for a hernia. The impulse of a cough, and the spasmodic action of the diaphragm in making a cough, is transmitted to the sac of fluid inside the abdominal cavity, and a wave carried down through the psoas abscess, which is felt in the groin, precisely as a wave is felt in ascites. This, if frequently repeated by coughing, may be mistaken for hernia. Ordinarily, however, other symptoms point to the occurrence of psoas abscess; such as long duration of the affection; some deformity of the spine; retraction of the leg and fascia in order to favor the parts; the lower position of the sac; for there is nothing to prevent the abscess from gravitating down the thigh, while there is in a case of hernia. The psoas abscess is of different and elongated shape; lies lower down; gives a peculiar thrill, more like the wave of ascites.

When a hernia is reducible and we push it back into the abdominal cavity, if there is bowel, we are usually conscious of the passage of air through the bowel as it goes back. This gives rise to a distinct noise, like air and water coming out of the neck of a bottle; and communicates a sensation to the fingers while they are holding the hernia. The hernia then slips back. The fact that air has got to go back in order to collapse the bowel guides us somewhat in the mode in which taxis should be used in trying to reduce the hernia. It is poor practice to seize the hernia and try to reduce it *en masse*. It should be drawn out a little, and alternately compressed and relaxed somewhat like the action of milking, so that air may be pumped out

by the action of the fingers into the abdominal cavity. In that way, frequently, success attends us; while a stronger pressure impacts the hernia more.

In making the efforts of taxis the position of the patient is of great importance. It is best that the shoulders should be lying a little lower than the pelvis; especially that the limb should be partially raised and abducted, in order to relax all the fasciæ; and the taxis must be made in an intelligent direction; in inguinal hernia upwards and outwards; in crural, downwards, backwards, upwards.

How long taxis should be persevered with depends upon how long the hernia has been down, and how much pain there is. If the patient can say confidently that he has had other attacks, and if you can feel that there is a large neck to the sac, the parts probably thickened and toughened, they will stand more pressure than the recent small rupture, that has been down only once or twice. Taxis sometimes does incalculable harm; and we occasionally operate for a strangulation, where we find evidences of bruises of the bowel; distinct ecchymoses in spots dotted on the bowel, where the taxis has caused extravasation in consequence of pressure. Nature fends off a good deal of this violence by the pouring out of serum. No hernia can be down long before serum begins to be secreted to lubricate the bowel; to soften the parts, and prevent that mischief we are doing by violent taxis. If effusion has already taken place, you can see how, in the exercise of taxis on the bowel through a water-bed, or cushion, it is protected a good deal from the effects of violence. It is almost universally the case, that in operating for strangulated hernia which has been down some time, in opening the sac there is a gush of serum before you come down to the bowel itself. The

application of cold, or heat either, to the sac will sometimes help return the bowel. Kneading the abdomen sometimes is very useful in aiding the taxis to get the bowel back. Total rest, soothing fomentations, and a dose of opium internally, sometimes are followed by spontaneous reduction. If the symptoms are at all grave, it is not very wise to give opium, because it masks the advance of the symptoms of real strangulation; and the subsidence of the pain, the ease of the patient from the effects of the opium, sometimes lead the physician to think that the strangulation is not going on very acutely. We shall see that other signs are present, which should guide us a great deal. Given, for instance, a moderate-sized hernia, which has got a pretty large neck, with not very acute symptoms; where we are, perhaps, not quite sure whether it may not be wholly omentum instead of bowel; where moderate taxis has failed; sometimes the application of hot or cold compresses upon the part, with position and rest, and the giving of some opium, and letting the patient rest over night, are followed by spontaneous relief. We must be guided by the gravity of the symptoms, whether it is wise to wait at all. In the incarcerated hernia which is becoming inflamed, it is very important that these attempts to subdue inflammation should be made at once. Applications should be used freely. The patient should be kept perfectly still; perhaps a little opium given; and gentle taxis used carefully to try to restore the bowel to its place; but if the incarceration remains and signs of inflammation come on, then I think we should operate, because adhesions are sure to form. If the patient escapes the dangers of an erysipelatous form of œdema of the scrotum, which is very apt to come on; at any rate, although he may save his life with a hernia still remaining, he will

have adhesions form, and be condemned to the misery of having ever after an irreducible hernia, which sooner or later, probably, will have to be operated on for his safety.

In strangulated hernia the constitutional signs are very marked. The patient feels the hernia come down usually while making some unusual effort. Either he has left off his truss; or his truss was insecurely fastened; or he was taking some high step; or occasionally the hernia is forced down while the patient happens to be straining at stool. He is conscious of a pain, a sense of tearing of the part. It becomes very painful; but the pain does not remain in that place long. It is speedily transferred to the rest of the abdominal cavity; and the characteristic pains are precisely like those of colic; circulate about the navel; manifestly confined largely to the small intestine, which is going through violent efforts of peristalsis, with retroactive motion of the gas and fluids, and with violent colic. The abdomen distends a little. The colic continues, and pretty soon nausea supervenes. The patient does not have much fever; the temperature is not usually high. He is in a state, rather, of depression, sweating, nausea; and while very severe symptoms do not continue about the sac of the hernia itself, the abdominal symptoms increase. Next to these comes on real vomiting; at first of the contents of the stomach; and subsequently to that a dry retching and straining, which forces the bile of the gall-ducts from the duodenum back to the stomach; and the next attack of vomiting is perhaps wholly of bile. Following this, if the case goes on unrelieved, there begins what is called stercoraceous vomiting. This consists of the partially-altered digestive fluids of the small intestine. The odor is very offensive; but it is not strictly fæcal in odor; it has that sickening, intestinal smell

with which we are familiar in the freshly opened body at an autopsy. The fluids are thick and gruel-like; extremely offensive. If these symptoms still go on, changes begin to take place about the hernia; the sac swells; œdema takes place. In the extreme case reddening takes place; and while this is going on the constitutional symptoms become very marked indeed. The countenance has a peculiar pinched and collapsed look. The capillary circulation is very early affected, and very noticeable. It will be observed, if you draw the finger sharply across the abdomen, that a deep white line is produced, and the circulation comes back slowly over it. If you look at the hands, they have a slight lividity about the nails; are cold, shrunken, covered with clammy sweat. The intelligence of the patient is perfectly retained; never is disturbed at all, just as in death from general peritonitis. The collapsed expression, the low temperature, the flickering pulse, sweats and bluish nails, and general stasis of the blood in the capillaries all over the abdomen and body, mark the stage that is going on. Such a condition as this, even if masked by opium, as it sometimes is where it is injudiciously given, still manifests these peculiar features of rapid and flickering pulse, and general symptoms of collapse. When such symptoms are present, after a while, although no opium is taken at all, pain absolutely ceases. Regurgitant vomiting frequently goes on without effort on the part of the patient. All pain ceases because mortification of the bowel has taken place, and the sensation is gone. This ushers in the latter stage, in which the patient usually sinks from collapse; or, if it happens to be a person of great vitality, and the circumstances favor, he may survive even this without operative interference. In that case, the sac finally forms an abscess and bursts. Then it is found that

the intestine has already burst in the sac, and with the pus come out the contents of the alimentary canal; and a fæcal fistula is established. When this is established, the patients recover, in a large majority of cases, with the bowel adherent at the ring, and an artificial anus formed at the site of the hernia. In a moderate proportion of cases of strangulated hernia, where the patients are unable to obtain any surgical relief, that is the final stage gone through with; and the patient survives with an artificial anus, where the hernia has ruptured into the sac and then formed an abscess. Usually, however, after the stages of collapse have come on, the patient rapidly sinks and dies with the ordinary symptoms of peritonitis and mortification, just as he does from other forms of strangulation or obstruction, higher up in the alimentary canal. We should then regard as extremely dangerous any case in which a patient tells us he has worn a truss some time; that his hernia goes back easily, but this time he cannot get it back; begins to have pain about the navel; a little nausea; little symptoms of distress; and we find the hernia down, and symptoms rapidly deepening. In such a case as this it is better to insist upon an operation than to leave the patient alone; premising always with the statement, that taxis shall be tried first, and, then, if that fails, an operation shall be done at once. One of the most useful modes of employing taxis is by giving ether. Ether throws the patient into a profound state of relaxation; and in that state, occasionally, the bowel collapses, and the hernia is put back without difficulty. The patient then should be etherized; taxis used moderately; and it should be understood, before he takes the ether, that the hernia is going to be put back into the abdominal cavity, in some way, before he wakes up; and if taxis fails, he may expect to have an

operation done while he is still under the ether. I do not know what it is, but I suppose it is the intense distress produced by strangulated hernia, and the feeling, probably, on the part of the patient, of great prostration and sickness which ensues, which reduces him to that mental condition that, as a rule, he rarely declines an operation for hernia. He assents almost always. The man with a leg crushed will frequently refuse operation for a long while; but the patient with a strangulated hernia rarely declines any interference you choose to give. The whole facts should be stated to him, of course. You must say, that if a mistake has been made in the diagnosis, if something else has been mistaken for hernia, an incision is the safest plan. We do no harm by the incision; and we settle our doubts. It would seem to be a proper rule, that in a case of suspected strangulated hernia, *when in doubt, we should operate;* because an incision will establish the diagnosis, and no harm will be done. On the other hand, many cases have been overlooked; suspected to be glands or buboes, or inflammations of various kinds; and after the person's death a concealed knuckle of intestine has been found in the inflammatory swelling, which might have been relieved if the diagnosis had been properly made.

As to the mortality of the operation for strangulated hernia, it depends almost entirely upon the period of strangulation; and the mortality increases directly with the length of the strangulation. In ordinary cases, from 25 per cent. to about 33 per cent. die after the operation for strangulated hernia. Three-fourths, or two-thirds get well at any rate. Of those who die, it will be found, almost always, that the strangulation has been so long that the bowel has been reduced to a bad state. The operation, if

done early and the bowel not seriously affected, is almost always successful. I tabulated the cases I have done at the hospital; and they are quite instructive in that way. Of 34 cases, 21 recovered and 13 died, or a mortality of more than one-third. The fatal cases had been strangulated as follows: 12 hours, 20, 21, 24, 27, 48, 96, 144, 240—several days, a few days, 10 days. The length of time the strangulation has existed is the great point. One of the most favorable cases I ever had I did this winter. I was called in the night, and found a very reasonable person indeed, with symptoms of hernia, which came on after going to stool in the evening, at nine o'clock. I saw her at two o'clock in the morning, with marked symptoms of strangulation coming on. At about five o'clock, that is, after the hernia had been down eight hours, the operation was all done; the intestine replaced, and everything over. No patient ever made in my hands so quick, or uninterrupted a recovery. Absolutely no symptoms followed the operation. I mention that as the type of a class. If this patient had hesitated, or the physician had hesitated, and waited five or six hours more for daylight and convenience, there is a fair chance that the scale would have been turned against her. Immediate operation, or immediate treatment of a strangulated hernia, is almost as imperative as the immediate treatment of a hæmorrhage; and if you can act speedily and be allowed to do so, almost all the cases will get well.

We said, in speaking of the anatomical arrangement of these layers, that we did not expect to find them all in dissecting for hernia. We do not. In the femoral hernia the coverings are apparently very much thinner than in the inguinal variety. You will be surprised, in the person not

very stout, if you operate in the groin, how very thin the coating is before you come down to the bowel. In the inguinal region, although the layers are anatomically no more in number, they appear to be thicker.

A good, long incision is desirable to drain the wound well. The skin and cellular tissue and superficial fascia should be rapidly cut through. Then pick your way down until you approach something of which you are in doubt. It looks dark and thin. One who is not accustomed to operating almost always feels afraid he has reached the bowel already. Usually, however, by careful watching with a strong light, you can make out a layer underneath, and can slide the layer under the finger over some layer beneath. If that is the case, it must be the peritoneum. You make a little prick, and there spurts out a jet of serum. Sometimes it is clear and sometimes bloody. Put in the director, and slit up the sac, and then you may find omentum or bowel immediately, or bowel beneath omentum. Omentum is unmistakable from the amount of fat; and the bowel is unmistakable from the thickness and firmness of its coats, and its shape. After you get down to the bowel you wonder how you could have thought the other could have been the bowel, they look so different. The strangulation having been uncovered and the sac thoroughly opened, the forefinger, thoroughly clean, of course, and in some cases thoroughly lubricated with carbolic acid and olive oil, is to be inserted. You then push around, about the bowel, and try to find the point of constriction. This often is a sharp, tense band lying across the top. The finger-nail only is inserted beneath that; and the hernia knife, guided on the nail, divides the stricture. This is the sole case in surgery where it is desirable to have a dull knife, with which to

divide the stricture. It yields very readily to a sawing motion with a dull knife. Make this little motion, following up with the finger, and presently you can push the finger through, and then withdraw the knife, and dilate with the finger. Then you are conscious that you are in the abdominal cavity. Then take hold of the bowel and try to reduce it, and it does not go back. The reason is, you have not found out which fold came down first, and which last. That which came last must be replaced first; and it is only by experiment that you can find the way it will go back. As a rule, the under portion came down last. Even if you can put it back at once, it is not wise to put it back without further investigation. Having dilated the hole, largely, take hold of the coil of intestine and draw it out, and see the distinction between healthy bowel and the piece that has been pinched; and the exact line of constriction across the bowel. The object is to see whether the bowel is healthy above, and to judge whether it is going to restore itself in circulation. Now comes the important point to decide, whether the intestine is so far injured that it cannot recover if replaced; whether it is going to slough. Anything short of absolute blackness, as a rule, can be put back; but a more important guide, I think, is the presence or absence of that glossy, shining surface of the bowel, which marks a state of reasonable health. The bowel which is going to slough has lost its bright look; is doughy; it feels softened a little upon the surface; and this, always, is a very bad sign. You may feel a good deal annoyed by finding that, although most of the bowel looks pretty well, there are a few little black dots. These are not usually followed by perforation. They generally recover, and the bowel may be put back. The object of keeping the bowel out in sight is this, also,

that after letting it stay a little while, you find its color improving. If it was originally of a chocolate-brown, it gradually begins to recover color; the circulation gains, and the shades of darkness on it begin to pass off; and you may be quite satisfied that it will recover entirely, if replaced, free and easy, in the warm abdominal cavity, where it can restore its circulation as it pleases.

Occasionally, we find that we have got down to a hernia where there are a good many adhesions. All these must be divided; vessels tied; pieces of omentum trimmed off and tied securely with silk; and the whole thing carefully pressed back into the abdominal cavity.

Another thing of importance, after pushing back the bowel and omentum, is to pass the finger into the abdominal cavity, and stir up everything inside thoroughly, to make sure that all twists and adhesions are relieved. I must warn you that a strangulation in an inguinal hernia may be at the internal abdominal ring, and up in the neck of the sac, and is frequently overlooked. You make an incision in the external ring, and free the bowel partly, and still leave a little constriction high up, which is found afterward to be the seat of fatal strangulation. Strangulation at the neck of the sac, strangulation at the internal abdominal ring, all these things are best guarded against by pushing the finger well into the abdomen, and being sure everything is free, all round about. After that, the cavity may be douched with corrosive sublimate, 1 to 10,000. Then you may do one of two things. If the patient is strong and young, and you think it is proper and justifiable, you may endeavor to sew up the sac, and fasten it to the pillars of the ring, and hope to produce a radical cure, and prevent a subsequent occurrence of the hernia; or you may, on the other hand, find that the

patient is already somewhat exhausted, and fear that such a prolonged operation will not be judicious; and, in that case, you content yourself with closing the wound. It is wiser to sew up the sac separately, with some form of suture you expect to remain innocuous in the tissues. Put in a drainage-tube, but not in the sac; and sew up the external wound, and proceed in the ordinary way to dress it antiseptically.

The subsequent history of the patient is usually rapid improvement. Sometimes, however, they hang fire a day or two. The passage of wind by the rectum, or a fæcal discharge, of course, is a good sign. But you need not despair at all if that does not occur for several days, provided there are no other symptoms of peritonitis, or of stoppage or obstruction, in any way. Occasionally diarrhœa sets in very soon after the reduction of the bowel; and sometimes leads to fatal result by enteritis. Usually, however, after annoying you a few days, this gradually subsides, and the patient recovers. When a diarrhœa occurs, it is wiser to give opium at once, and try to check it after a few passages have taken place. All this is in the ordinary case.

Suppose the case where you find the bowel so dark you are afraid to return it. Two courses are open. One is easy and pretty sure to save the patient, at the expense of great annoyance; and the other more difficult and dangerous. The easy course is to open the bowel and make an artificial anus. The patient almost always recovers. This fæcal fistula frequently cures itself after a few weeks. It shrinks and heals. The other mode, that is much more severe, is to draw down the bowel, excise the dead portion, match the ends of the bowel together, and do a positive resection; and return the whole, sewed together, into the abdominal cavity.

This takes a good deal of time; and you must depend a good deal upon the state of shock the patient is in — how much collapse — whether you can venture to go through this operation. If it can be done, and the patient survive it, he is cured without the occurrence of artificial anus.

Sometimes we find nothing but omentum is strangulated. Then we slit up the opening and draw down the omentum, and cut it away if it looks inflamed and infiltrated, and return the stump into the abdominal cavity. It is very good practice to take the stump, which is healthy, and sew it into the inguinal canal, that it may remain as a plug to prevent the subsequent occurrence of hernia; and then the wound is dressed in the ordinary way.

Umbilical Hernia.— Umbilical hernia is very fatal. There is no sac. We come down at once into a large peritoneal cavity; and it is like doing a laparotomy with an inflamed peritoneum. A large percentage of the umbilical herniæ which are strangulated die. Some, however, recover. There can be no question as to the necessity of operation when the symptoms of strangulation exist.

On account of the frequent occurrence of hernia, efforts have been made in all ages to try to do what is called the radical cure, to prevent it from coming down. These efforts date far back to the time of Ambroise Paré, and even before that. Sometimes these efforts were quite successful. Back in the Middle Ages, castration was performed as a cure for hernia; and followed by burning and searing the stump and the site of the hernia with a hot iron. This was quite successful. The opening was closed; and a deep scar was formed, which cured the hernia at the expense of the loss of the testis.

Ambroise Paré first introduced the method of sewing by

what he called the golden stitch. It was quite a good imitation of the modern methods of antiseptic surgery. Subsequent to that, the operation of Wurtzer was introduced. Subsequent to that, Mr. Wood, of London, introduced his operation, which was similar to that of Paré.

In modern times we have arrived at a safer way of doing things, because by the antiseptic method we can now do openly what we had to do secretly. The earliest stages of antiseptic surgery seem to date from the time when Dieffenbach introduced subcutaneous surgery. Suppuration never took place. Following this, in various ways, attempts were made to operate on herniæ subcutaneously, without the introduction of air. To this class belong all the forms of subcutaneous injection of astringents and other fluids, used to shrink up the sac and promote adhesions. All these operations, even down to the time of Mr. Wood, had to be done out of sight; but since the antiseptic period of surgery we have gained very much, because we venture to cut down boldly, to see what we are about, and operate directly on the hernia, precisely as you should do in a case of herniotomy for strangulation.

The modern operations are, to go through the stages of herniotomy; go through skin and tissues; cut to the inguinal canal; then uncover the sac, and invaginate the sac into the ring; sew it to the pillars; and plug the whole opening; and expect to get immediate union without suppuration. This latter form of operation, done largely by Macewen, and modified by Dr. McBurney, is claimed to give better results than many others.[1] No operation can succeed in curing the hernia unless it obliterates the serous canal through which the hernia comes down. Although, for the first few weeks

[1] Bassini's operation has now become the favorite one.

after one of these operations is done, the patient appears to be entirely cured, in a very considerable portion of cases the hernia relapses; and after six to twelve months comes again; so that the radical cure is by no means a certain operation; there being a large percentage still of failures, if you give the patient time enough to see whether a failure is going to result. The large proportion of cures you see asserted by some authors is due to the fact that the case is not followed up; and cures exist temporarily, but are not permanent, in the large number of cases. Why is this the case? Apparently because all cures of hernia must depend first, on obliterating the serous canal, and, next, in the getting up of adhesive inflammation — adhesive lymph and fibrous tissue, which will shrink up and hold the parts together. Failure occurs because this lymph is subsequently absorbed. It is one of the peculiar habits of nature, that in certain parts of the body where we get up an inflammation and get lymph deposited, it is absorbed; and in certain other parts of the body it is not absorbed.

Instance the difference between hernia and stricture of the urethra. In stricture we have shrinking and contraction. It may be dilated, cut, ruptured, and yet its permanency is not always destroyed. It tends to recur. The contractility and the deposit of lymph tend to remain permanent. On the other hand, unfortunately, in the inguinal canal and about the sac of hernia, the lymph you succeed in getting poured out is very readily absorbed; and six to twelve months suffice to take away every trace, sometimes, of the operation; to thin the parts, and leave another rupture protruding. I would not be understood as wishing to discourage the attempts at a radical cure; only no method has yet been found which is sure to produce it.

Is not such an operation likely to benefit the patient, if it does not cure? It is; and especially in the case of large hernia. In that case, after the hernia is restored, and the parts stitched together and adhesions produced, we shall obtain some advantage over the previous condition. The opening will become smaller; the walls firmer; retention of a truss easier; and, in that way, the patient will be benefited. If it is a patient of from ten to twenty years, the chance of cure is very good indeed. The chance for permanent cure diminishes as age goes on. If the person is past thirty-five or forty, radical cure is not likely to result. The opening will be smaller; retention easier; and certain good results may ensue. If this is explained to the patient, he may consider it wise to undergo the operation, even though he may not get perfectly cured.

In childhood, many cures are produced without operation. Nature tries to cure the opening. The child is growing; all the tissues change; and if the rupture can be held back long enough, and never suffered once to escape, frequently the sac will be made permanently adhesive, the rupture cease, and the child perfectly cured; so that in little children, if you put on a hard truss; if it is thoroughly and completely applied and worn for a few years, it may be followed by cure. In little children and young subjects, the operation for sewing up and invaginating and injecting, etc., is followed by a large number of successes.

What is it wise to do in the subject who has had, for many years, a large hernia, that is irreducible; with adhesions formed; and which has to be constantly worn down in the scrotum? He is obliged to wear a large suspensory apparatus, and go about with an irreducible hernia. He may go on in that way for years without great danger; on

the other hand, he is in a condition where peril is likely to take place at any time. The mere presence of adhesions in this sac gives rise to excellent chances for obstruction and twists to take place, at any time where an unusual muscular effort is being made, or an attack of indigestion comes on; consequently, the patient with an irreducible hernia is never absolutely safe from the chances of strangulation or incarceration. If, then, an operation can be done to restore the parts to their natural place, although you may not succeed in effecting a radical cure, still you can almost always mend matters so that the patient can support the parts with a truss; and the chances of a strangulation, while he is careful, are very much diminished. The size of the hernia, and the size of the patient, so to speak, must be, to a certain extent, a guide to you. Instances have occurred in which so large a part of the alimentary canal has been carried for a long time in the scrotum, that there was no longer room in the abdominal cavity to get it in, after an attempted operation. The abdomen was too small to hold the intestinal contents; and such a condition as this must be a terrible problem to solve, when the operator comes to it. He may try to sacrifice omentum; but he would have a very long and dangerous operation.

Gibbon was found, at the autopsy, to have the pyloric orifice of the stomach in the scrotum; yet being a man of sedentary habits and quiet life, he lived to fair old age, even with this deformity.

XXXI.

STRICTURE OF THE URETHRA.

In the very large majority of cases it is the result of gonorrhœal inflammation; not, however, from the early or acute disease, but from a case which runs on a good while and is imperfectly cured. The earliest effect of the inflammation of the mucous membrane of the urethra from the gonorrhœal poison is swelling up of the mucous membrane, discharge of serum and then of pus. Finally, this declines until the discharge becomes nearly transparent and painless, and the symptoms of acute inflammation go down. It is a very common thing in the early stages to have the urethra so swollen, that not only is there great pain in passing water, but the patient is subject to spasmodic attacks of retention. This, however, is not real stricture. Real stricture occurs more slowly and insidiously; and seems to be due to the fact, that long-continued inflammation of the mucous membrane of the urethra afterwards leads to fibrous deposits; cellular infiltration between the muscular and mucous coats; and the deposit there of lymph, at any part of the urethral canal. However, as it is apt to occur in the more chronic cases, after the disease has penetrated far back in the canal, stricture is more common near the prostatic portion, and about the membranous portion of the urethra. It may also form at any part of the penile portion of the urethra. There may be several strictures. They may be on one side; may be all around; and may be more or less con-

stricted. Those that are recent are easily stretched; and those that are old are very tough and cicatricial; and the more they are interfered with, without being thoroughly dilated, the more tough they become. In old cases they seem to be almost as tough as india-rubber; and although they admit a bougie at first, they cling to it quite as tightly when it is withdrawn; and when the next one is inserted, the same resistance is felt.

The signs of stricture are very important, because it comes on insidiously, without attracting much notice on the part of the patient. Unlike spasmodic stricture, which is acutely painful, chronic stricture is not painful at first, and does not give rise to real retention. One of the earliest signs that attracts the patient's attention is the fact, that the act of urination is not perfect; and although he has been to pass water and thinks it is entirely finished, subsequently there will slowly dribble from the urethra two or three drops of urine, and he will be conscious that he has become wet, and without any sensation. This slight leaking is due to the fact that the fibres of the accelerator urinæ, at some part of their course, have been interfered with by fibrous bands of adhesions.

It is often said that the earliest sign of stricture is a twisting, or bending of the stream; the stream not being thrown out in a round column. This, however, I do not think is a sign of much importance. Many people do not pass a round stream of water, who have no stricture; for the shape of the stream is regulated, almost entirely, by the little fibres at the mouth of the meatus urinarius. It is well known, that when these fibres are divided, as is often done, the stream subsequently remains flattened and broad, and not so round and perfect as it was at first. So

there may be various slight defects about the urethra which do not amount to stricture, but which will lead to flattening, or twisting of the stream.

The two signs which are most important are slight dribbling, and, secondly, loss of force in the stream. The bladder may make violent efforts at expulsion; the patient strain to throw the water out vigorously; and yet the flow of the stream will be shortened; and after a while, in the bad cases, it will lose almost all its force, and even, instead of being thrown off from the penis, begin to drop perpendicularly downwards, instead of having any force like a jet. A dribbling, accompanied not by pain, but by the sensation that he exerts rather an unusual amount of force to pass water, are among the early signs. When that is the case, the other signs soon become so marked that they are unmistakable. Not only does the stream cease to be thrown out, but it finally begins to be passed interruptedly, or by drops; and the current becomes so small that it is passed only a few drops at a time, and without any force. This must not be confounded with that irritation of the neck of the bladder, or spasmodic effort, which occurs occasionally in healthy individuals in passing water, so that they pass it in successive impulses, or jets. That is merely a temporary congestion, and a form of spasmodic stricture in which the circular fibres at the neck of the bladder contract prematurely, and cut off the stream momentarily into a series of columns of water. In the true stricture, this interruption occurs even to the extent of making the urine flow by drops; and the force is wholly lost in its ejection from the mouth of the urethra.

Long before this stage is passed the patient begins to experience other symptoms. Most noticeable are increased

frequency in the call to make water. He wishes to go very often. The amount passed may be small, and accomplished with great difficulty; but there is an irritability of the part which calls for frequent urination. Pretty soon after this, if the stricture has progressed to a considerable degree, partial retention takes place; and he fails to empty the bladder completely. At first, for a while, he may be unconscious of this; the bladder having become accustomed to tolerate a certain amount of urine in the basin of the pelvis and behind the prostate without inconvenience; and the patient feels relieved in passing off, perhaps, an ounce or two on the surface, without actually emptying the bladder. The consequence of these repeated strainings, of this failing of the stream, and this frequency in passing water are that, as the stricture grows smaller, the urethra begins to stretch and thin, and grow larger and larger behind the site of the stricture; so that accompanying the stricture, if it is of considerable duration, there is always a dilatation of the urethra behind the stricture itself. This dilatation is of importance, inasmuch, as, after a while, it leads to thinning of the walls and softening; and if any inflammation of the urethra develops there; or even without any fresh urethritis, if the urine lies in this pocket and decomposes, eventually ulceration is set up, and finally we have a rupture of the urethra behind the stricture, through a small pin-hole opening, and a slight extravasation in and about the perineal tissues. The effect on the bladder of this stoppage of the stream is quite disastrous. The muscular coat becomes increased in force, just as the heart increases in power, owing to obstruction of some of the valves. At the same time it becomes distended, frequently, to a considerable degree; and, gradually, the urine, being incompletely

emptied from the bladder, decomposes as it lies there, and sets up an inflammation of the bladder itself; the urine becoming alkaline and ammoniacal; and leading to a great secretion, first of mucus in the bladder, and finally even to a purulent condition in the bladder walls. This again reacts on the ureters; and in the very bad case leads to their distention, and finally to distention and backing up of the urine in the pelvis of the kidneys; and eventually, if long enough continued, to disease of the kidneys themselves. Of course, all this is in the extreme case. The majority of mankind seek some mode of relief, and are relieved temporarily by some form of treatment. The well-advanced stricture, with frequent urination, also produces other symptoms in the pelvic organs, especially in the rectum; and it is frequently accompanied by slight discharges from the rectum, occasional prolapse; and by tenesmus, and the gradual dilatation of the hæmorrhoidal veins, a prolapse of internal piles; and sometimes the physician mistakes the location of the disease; it being sometimes sought in the rectum, when it really exists in the bladder itself. Stone in the bladder, also, produces the same chain of symptoms in the rectum. It is not uncommon for a patient to apply for treatment on account of great trouble in the bowel, when the real disease exists in the bladder in the form of a calculus, which is lying behind the prostate, and giving rise to the most terrible efforts at expulsion, whenever it shifts its position.

That is the ordinary history of stricture. Unfortunately, it happens that the lymph that is deposited about the urethra is tough, elastic, not easily absorbed, and cicatricial in character; that is, it is contractile; does not tend to go away; tends to re-form every time it is interfered with. So much is this the case, that some of the older surgeons have come to

say, that a well-marked stricture of the urethra is practically incurable. It is claimed by the advocates of internal urethrotomy, who divide the stricture in a longitudinal direction, and follow this by dilatation or stretching the urethra by a very large-sized sound, that the stricture is permanently cured. I do not think sufficient time has elapsed, or statistics enough have been collected, to make this clear. A good many cases relapse after this form of treatment. Some, perhaps, do not. Undoubtedly the division of the stricture in the longitudinal direction is better than its rupture in an irregular or transverse direction; but the unfortunate history is, that in the majority of people, a stricture, once formed, tends to come back again, unless it is kept constantly dilated.

Now a great variety of manœuvres have been used to try to cure it, of which the simplest and safest is what is called gradual dilatation. This consists in passing through the stricture, having located it by means of a bulb bougie, soft bougies of various sizes, gradually increasing until the stricture is widely opened. This should be done very gradually; and the safety of the process, and the permanence or durability of the cure, depend, I think, a good deal upon the slowness with which it is done. Any attempt at dilatation which is so rapid as to provoke resistance and inflammation merely leads to tightening up of the stricture, and increase of inflammation in the urethra, and more aggravated symptoms. The simplest and best way is to proceed very cautiously and slowly by gradual dilatation. The process takes four to six weeks, according to the tightness and toughness of the stricture, and its location. During this time it is important that the patient should be kept, in the earlier part of the treatment, quiet. If he can be persuaded to lie on a sofa or in bed, he gets well much quicker than if he pursues the

opposite course. Many patients insist on being treated while going about their usual pursuits. They do not get on so fast, or so well. The sensitiveness of different people differs enormously. Some will bear dilatation without shrinking; and in others it produces severe nervous symptoms; not only the ordinary urethral chill, but pain in passing water, irritation of the bladder, etc. To guard against this, if we can have our way, I think the typical plan is to get the patient in bed, and keep him there a week or two, in the earliest stages of the treatment; clear out the bowels thoroughly, and keep him on moderate diet, in which there should be absolutely no alcohol and comparatively little meat. Give him abundant demulcents to drink; keep him still; avoid the use of alcohol or highly-seasoned food. Then the surgeon proceeds with the bougies very slowly. Two or three days ought to elapse between the passage of the bougies for the first fortnight. If you go too fast, you merely irritate the stricture. A size should be chosen that will go through easily; then take the next larger size, by the French scale, and pass that down; and if you cannot get it through the stricture, bury it firmly in the stricture, and leave it impacted in it for a short time; then wait a day or two, and begin again with the same size. I am quite convinced that, if you try to pass a bougie every day at first, you will defeat your purpose. The urethra will get irritated, spasmodic stricture will be added to the other stricture, and you will not get on so fast. Later, after the stricture has begun to be well opened, you can go on rather more rapidly, and increase your sizes more rapidly, and, finally, when the full size has been reached, the patient can be instructed to pass bougies himself. He must be told that he cannot afford to neglect this at all; that once a week is often enough; it had better

be done in the evening, on going to bed. The bougie should be passed once a week, perhaps after a warm bath, for many months, and perhaps even for years. Now the unfortunate tendency is in all individuals, after the stricture has been relieved, to be a little careless about passing the bougies. At first the patient may be very conscientious; but he finds, after he omits a few times, that the bougie does not go so easily, and he shrinks, and then selects a smaller size. And so he goes on; and by-and-by the stricture returns to its original state of contraction.

Gradual dilatation, then, is the best treatment; because it is perfectly safe; and complications, if the patient will take time for it, can hardly arise. It seems to me, also, it is probably about as durable as the other forms of treatment, because it leads to very slow stretching and absorption of the cicatricial tissue, and restores the urethra to a healthy size, without violent interference. Sometimes when the patient is lying off in this way, if we find he is very tolerant of the instrument, we may gain something by leaving the bougie fastened in the stricture twenty-four hours. This, occasionally, is a very excellent step. Pass a good-sized bougie which buries itself firmly; withdraw, take the next smaller size, and let it stay in the stricture; and fasten it in twelve to twenty-four hours according to the amount of irritation which exists. If it does not irritate the bladder, it can stay twenty-four hours. The result is to melt down and soften the stricture very rapidly, so that, after withdrawing the bougie, you will find that a considerably larger size can be passed with ease. In this way you can vary the treatment, and get on a little faster than by the other method.

This sort of treatment is too slow for a good many persons; and it is also, perhaps, too slow for the desire to cure

the patients of a good many surgeons. Consequently other methods more rapid and radical have been suggested. Of these the first is what is called rapid, or instantaneous dilatation of the stricture. This is done by rupture, either with Holt's instrument, or Goulet's. In a simple case the guide is passed through the stricture. On this a metal tube is slid, which is conical; this enters easily the stricture and can be forced through. This mode of treatment cannot be done without ether, as a rule. Of course, the presence of the guide in the stricture renders it quite sure that the rupture can only take place, and the tube only pass, in the normal urethral canal. It is done in Holt's instrument by a straight guide; in Goulet's, by passing a horse-hair-tipped elastic bougie down, and sliding the steel instrument over it. Having begun this treatment, we should complete it at one stroke. The patient is profoundly etherized; the guide passed; and one after another of these dilators is forced down, with a good deal of force usually, through the stricture, on the guide, into the bladder, until the largest size is attained; then both the guide and the dilator are taken away, and a full-sized catheter fastened into the bladder. If a catheter is to be fastened in the bladder, of course the elastic one is the one to use if it is possible, because the silver one, fastened in the bladder, is very painful; does not lie snugly and nicely in position; the beak rests against the bladder: irritates the patient, and is sometimes dangerous; whereas the elastic catheter, which can be passed in on a stilette and the stilette withdrawn, is perfectly safe. A good, fresh, strong elastic catheter must be sought for. Those which are at all old and brittle are extremely dangerous, inasmuch as it has happened a number of times, that after passing one of these old and brittle catheters into the

bladder, on withdrawing the stilette the catheter curls up and cracks, and a piece drops off in the bladder, and becomes a nucleus for phosphatic deposits, and has to be removed by a cutting operation. That is the treatment by rapid dilatation. It simply bursts the stricture, and it is not free from danger; but it is, also, if it succeeds, rapidly successful. We conquer the stricture in a few minutes. We then introduce a large instrument and leave it several days, while the parts are healing to a certain degree, in order to avoid infiltration of urine about the ruptured urethra. I am quite sure the urethra is ruptured in these attempts, although those who have invented this instrument claim that the mucous membrane is not ruptured, but that the strictured portion is torn; but there can be but little doubt, I think, that the mucous membrane of the urethra must be, in a good many cases, torn and lacerated. That is a rough and brutal way of treating stricture. It is, however, about as successful, as regards danger to life, as the operation of cutting internally. The essentials of treatment consist in doing it thoroughly when it is done at all; getting in as large an instrument as you can, and keeping it in the bladder several days. Longer than that it is of no possible use. Sometimes it is useless after thirty-six hours. We know that when a patient makes an effort to pass water, and has a leakage between the tube and urethra, the catheter is doing no good; infiltration is then more likely to take place than if no catheter is in. If it begins to be moist on the outside it should be carefully watched; and this is the sign that it no longer accomplishes the purpose for which it was put in.

The next operation which is used, and which has become the most popular of late years, is what is called internal urethrotomy; cutting the stricture from the inside. This

mode is effectual. You cut and stretch by an ingenious combination of instruments, of which there are various names. This, also, must be followed by the immediate introduction and retention of a large catheter. This operation seems to be much more safe in penile strictures, than in the deep ones in the membranous portion of the urethra and in the bulb. The bulb is very vascular, filled with large veins. The membranous portion and the perineum are quite liable to infiltration; and if hæmorrhage takes place far down, it is more difficult to control it than in the penile portion of the urethra. If the stricture lies between the meatus urinarius and bulb, it is a good one to cut internally; but if it lies behind the bulb, there is more danger of hæmorrhage and subsequent infiltration. In the stricture which is in the penile portion above the bulb, if cut and if hæmorrhage results, the hæmorrhage can be easily controlled by fastening a large catheter in the penis and bladder, and strapping the penis firmly, and making compression along the urethra, so that hæmorrhage cannot take place. A few hours of this treatment suffices to arrest the hæmorrhage, after which the catheter can be taken out. But it is impossible to perfectly compress the bulb or perineum around the catheter. We may do it to a certain degree by little weights and bags on the perineum. An ice-bag, or coil, around the scrotum and perineum, and about the anus, is quite effectual in checking hæmorrhage in these deeper cases.

It was formerly the custom to regard this operation so lightly, that it was done sometimes in the physician's office. The patient then immediately went home; but it must be considered that this can only be done at a considerable risk; and it seems to me it is not safe to do it unless we can keep

the patient still; and be on the lookout for hæmorrhage and urinary infiltration.

You are familiar with the method of Otis, which consists in cutting and stretching enormously; dividing the meatus urinarius, and bringing the size of the urethra up to what he thinks the normal limit, which he considers to bear a certain relation to the circumference of the penis in its flaccid condition. By this method the urethra has been distended far more than was formerly thought possible; and undoubtedly sometimes with benefit; and one thing more, which this has led to, and assisted in very much, and that is in the operation with the lithotrite, and methods for rapid evacuation for stone; it has tested the possible capacity of the urethra without really injuring it.

A tight stricture is occasionally operated on through the perineum by cutting outside; and this method was first extensively used by Mr. Syme, of Edinburgh, and is called Syme's operation. We introduce the whalebone bougie with a little guide down through the stricture. We then pass down a curved sound, or curved staff, as far down as the site of the stricture. We then cut in the perineum down upon the point of this sound. We then find the healthy urethra with the sound in it; reach the edge of the stricture; through the stricture is lying the little whalebone bougie which leads us in on our course; we carefully pick our way through the stricture, and the moment we pass that we get into the dilatable membranous portion of the urethra, and it is perfectly easy then to pass a large instrument into the bladder. Two courses are sometimes adopted. Sometimes a large catheter is passed through the passage from the meatus to the bladder, and fastened in; and sometimes the urine is allowed to remain flowing through the

perineum, and a bougie occasionally passed to keep open the natural passage. The treatment used in former times was somewhat objectionable. This was always to put in a large bougie or catheter after external urethrotomy, and to keep it in for days, and perhaps weeks; changing it for the purpose of cleanliness; it being expected that the wound in the urethra, which communicated with the air through the perineum, would granulate up and heal around over the catheter. Sometimes it will, and sometimes not. There is not any question that healing is retarded in this way; and occasionally instances occurred in which obstinate perineal fistula, which could not be closed, resulted from this method of treatment. Moreover, unless the bladder is constantly siphoned by a rubber tube attached to an elastic catheter, and carried over the side of the bed into a bottle partially full of water under the bed, and the bladder kept drained all the time; unless this is done very speedily, on account of the irritation of the bladder and spasmodic efforts to pass water, urine begins to trickle by the side of the catheter, as it did in the other case of which we spoke. This indicates that the catheter is no longer doing good. This effectually prevents healing, because it checks the granulating process and keeps the sinus open. Therefore, there can be no doubt, I think, that the long retention of an elastic catheter in the urethra after external urethrotomy is not desirable. It is better, if it is put in at all, that it should be taken out after twenty-four hours, and the stricture kept open by the passage of an instrument once in two or three days, or something of that kind.

Next come the class of cases where the stricture has got so bad that no instrument can be got in at all; impassable strictures; not strictly so. I suppose there is no such thing

as impassable stricture, unless there happens to exist three or four false passages through the perineum, where, as we sometimes see in the old case, the patient passes all the water through the perineum by three or four different outlets; tortuous sinuses communicating with the deeper parts of the urethra; but, ordinarily, a stricture is not impassable. A drop or two of urine escapes through it; and where a drop or two of urine goes through, a stricture should not be considered as impassable; but we ought to try repeatedly with minute, filiform bougies to find that course, and to get a guide into the bladder. This can sometimes be accomplished by filling the healthy portion of the urethra with five or six small filiform bougies. We pass one down to the stricture. It fails to enter. We pass another, etc., until the urethra becomes filled with these little bougies, and stretched so much, that, by a lucky chance, the fourth or fifth happens to catch in the opening of the stricture, and goes on into the bladder. Frequently a great deal can be done by bending the bougie at a sharp angle, and then rotating lightly in the hand, and seeking in that way to make the point turn about until it engages itself in the passage. Force defeats your efforts. No force must be used. I would not argue that every stricture can be got through in this way. I admit there are occasional cases of impassable stricture. All efforts fail, and something has to be done, because either the patient is in danger of fresh extravasation in the perineum, or has already been through that, and has formed sinuses which it is desirable to close. It is essential that a direct outlet should be got into the bladder. In this case, external urethrotomy has to be done without a guide. This is done in two ways: either a modification of Syme's operation, passing down a sound with a

conical point as far as it will go in the stricture; drawing the penis up and holding it firmly down against that; and cutting down until we come to the healthy urethra; drawing the parts apart, and by patient dissecting and picking, endeavoring to find the other end of the urethra, and to get into the bladder. That is a modification of the Syme method. It is almost always a very long operation. It is uncertain; and sometimes we fail, even after a prolonged laceration of the parts, to find the internal opening. Having gone so far, and having failed, it obviously will not do to stop there. We have failed to get into the bladder; have wounded the parts so that they easily become absorbing surfaces for any septic action set up by infiltration; and a direct outlet must be given to the urine, through a large opening, through the perineum. What is called Mr. Cock's method meets this difficulty. As I understand his method, it was to enter the bladder without a guide; or rather, to enter the membranous urethra; and the guide was the finger in the rectum, pressing it on the isthmus of the prostate gland, and having the membranous portion lie on the finger. The surgeon passed the knife until he was conscious the point came down nearly to his finger, and slid it along until it entered the membranous urethra, and followed it by a bougie. The operation, however, as it has been done here, is a little bolder. The early stages of the operation are precisely the same, but the surgeon, instead of stopping after he has slid along the back of the knife on the finger to the membranous urethra, inclines the knife upwards, and passes it into the bladder. This requires a knife about four inches long, with a narrow blade, which glides down upon the finger in the rectum, follows the median line, and is slid slowly towards the pubes, through the prostate, into

the bladder. This operation is generally successful. The bladder is promptly opened, and a large outlet afforded to the urine. The urine is at once seen to trickle by the side of the knife before it is withdrawn. The surgeon then takes the director, and holding the knife in position, slides the director down by it into the bladder, and withdraws the knife, and follows the director on with the dilator, or finger, or bougie, or catheter, until he gets a free outlet; then a very large catheter is passed through the perineal wound into the bladder, but not through the penis, and the patient is allowed to have the urine flow off freely through the perineum. This operation has these advantages and defects:

First its defects. One defect is that it does not cure the stricture. The stricture has got to be operated on afterwards. You have gone behind the stricture, have not restored the normal urethral canal; and subsequently to that, the patient has again to be etherized, the urethra to be restored by a fresh incision, so that the upper part is connected to the lower; and then a catheter passed into the bladder and the perineal wound allowed to heal in the ordinary way, with the passage of a steel sound, of good size, once in two or three days until it is healed. That is one defect of the operation. Another defect of the operation is the chance that you may not get the blade of your knife exactly through the prostatic urethra, and may wound the prostate itself; may inflict damage on the seminal ducts in the prostatic sinus; may meet with some subsequent infiltration or inflammation there, which will interfere with the action of the ducts; may set up prostatitis, or some complication of that kind. This danger is not very great; and statistics of the operation, as a temporary expedient to

let off the urine, are good. I would not advocate it as an operation to be done when anything else can be done. Most of the cases have recovered, unless the patients had disease of the kidneys, in which case it is almost always fatal.

Let us see the cases to which it is applicable. I think it is applicable to those terrible cases of extravasation of urine occurring in people of low and degraded and exposed life, and most frequently in drunkards after great debauch, who are brought into the hospital. Those patients are in a deplorable condition, in which they are going to die in twenty-four to forty-eight hours, unless they are relieved. There has been a rupture of the urethra. The urine has already infiltrated so that it has filled the scrotum and penis, and in some cases flows on the pubes; and in extreme cases we have seen it extend nearly up to the navel; the abdominal cellular tissue being filled with urine and gas; the scrotum almost sloughing, and the patient approaching a state of collapse. Everybody knows that this condition demands two things: in the first place, the most prompt and free incisions through the infiltrated tissues in order to prevent extensive death of the parts from decomposition. Every surgeon admits that; but the other *sine qua non* is to get a direct and large opening into the bladder, so that no urine can possibly infiltrate afterwards; and it is in this condition of the parts, where the stricture has existed a long while, where the urethra has burst behind the stricture, where any attempt at catheterization fails, that Cock's operation, as modified, gives the best results. Free cutting of all sloughing parts; carefully seeking for the prostate and membranous urethra; passing the knife exactly through the perineal centre, through the prostate, up to the bladder; passing a guide, passing a catheter, and

dressing the parts. In the large majority of cases of this operation, where the patient does not die from delirium tremens, or where the kidneys are not already diseased, recovery ensues, and ensues with marvellous rapidity. In twenty-four to thirty-six hours the patient is evidently rapidly approaching convalescence. The swelling goes down with immense rapidity. It is almost laughable to see, if you operate on one of these cases in the afternoon, by the next morning this enormous swelling all gone; and the patient comfortable, unless he is suffering from delirium tremens.

I believe in the most gentle, gradual, painstaking method to cure strictures, if you have time. I would much rather do gradual dilatation than any other way. If we are obliged to resort to other methods, and if a guide can be got through the stricture, this operation of Cock's is not justifiable; but in stages of extreme extravasation, with impossibility of relief, it is absolutely the only safety for the patient to get a direct, straight road into the bladder. Yet there are other ways of doing this. You can draw the urine in other ways.

The old way was to tap the bladder through the rectum. This is in a case of distention, retention and commencing extravasation. The surgeon passes his forefinger into the rectum and finds the isthmus of the prostate. He endeavors to push it still farther until he can get beyond the prostate and feel the bladder wall bulging against his finger in the vesical trigone. Then he takes a long curved trocar and thrusts it up into the bladder, and the urine is emptied at once. The disadvantage of this method is that it is impossible to keep the wound open. You may then pass in carefully a guide, and put a good large silver, or elastic catheter

into the bladder, and fasten it in. It will stay a little while; but within twenty-four hours it is thrown out by the passage of gas from the rectum, or by a passage from the bowels. You do not establish a leak into the rectum of any duration. It is extraordinary how soon nature patches up this hole, and the bladder fills up again; and a permanent fistula into the rectum is not established in this way.

A much safer way, I think, where we must immediately empty the bladder, and do not wish to do any bolder operation, is to aspirate above the pubes. This is a harmless operation, if properly done; and so harmless, that it can be repeated five or six — I don't know but more — times on the same individual, without any real danger.

In this case, the only points are, to have antiseptic cleanliness about the wound and the instruments; to shave the pubes; have the parts thoroughly scrubbed and washed; and to enter the bladder close down to the level of the pubes. The needle should be small; for urine will flow through a small needle; and it is very wise not to take the needle and bore it through all the tissues into the bladder. The needle gets choked either with skin, or cellular tissue and fat; and it is best to make a preliminary incision down to the fat. This incision should be small, transverse, perhaps one-eighth to one-fourth inch in length, but pretty deep. Then take the needle, properly prepared, and holding it parallel to the pubes, or inclined a little downwards and inwards, towards the base of the pelvis, rotate it in, and it will go with ease and without blocking up its lumen. Probably the moment you withdraw the stilette you see the urine flow; or, if the needle is already attached to the evacuator, it can be drawn off without difficulty in a bottle; the bottle emptied and refilled, until

the bladder is reasonably empty. After you have drawn off one bottleful, you will find, perhaps, it will cease to flow. Push the needle about cautiously towards the fundus, and it will flow again. When you have drawn off a fair quantity, and touch anything and a little blood comes, you had better stop, for you are pricking the mucous membrane of the bladder.

Frequently the result of doing this once is, that the patient after resting twelve to twenty-four hours, is able to pass urine through his stricture, to a moderate degree, enough to relieve himself. If not, aspirate again. It is wiser to do it once in twelve to eighteen hours, than to wait too long. If you wait too long, the bladder gets distended; pain comes on; and nothing is gained. I regard this as one of the best improvements in urinary surgery that has been made. It is not dangerous; does not injure the bladder; it is speedy and not painful; it is preferable, in these respects, to tapping through the rectum.

XXXII.

AFFECTIONS OF THE BLADDER.

THERE are two forms of extravasation of urine with which it seems very necessary to be familiar. One form is due to stricture, and dilatation and ulceration of the urethra behind it, and a giving way of the wall forming a minute opening. This is followed by some sensation of pain every time the patient passes water, and some straining; not by very marked symptoms. With this condition the patient will continue to walk about and follow his usual occupation, for some days. Moreover, the external appearances are not very marked. A small, hardened spot will be found in the perineum just behind the bulb, which feels merely hard, is not red or tender. This, however, is a small pocket of urine extravasated into the tissues, and it will very gradually extend; because with a small opening the hyraulic force behind it is relatively small, and the amount of urine pumped out into the tissues at each time of urination is, perhaps, but two or three drops; so that this condition may go on a good while before it gives rise to extensive extravasation, if, indeed, it ever does. The thing it does do is, usually, to lie so long in this place, and to gradually decompose, so that local abscess results, and the patient has what is called perineal abscess. This having evacuated itself, or been opened, gives exit to pus, and finally forms a urinary fistula.

Now, on the other hand, there is the other form of extrav-

asation of urine, which is very rapid and intense in its effects, where the urethra has given way in front of the triangular ligament to a large extent, sometimes as a result of strictures, frequently the result of violence. In this case the rent is large; urine is pumped out into the tissues rapidly; and being checked from going back towards the nates by the attachment of the fascia, which forms an exact line along the middle of the perineum, it is turned forward into the loose tissues of the bulb, cellular tissue of the penis, and into the scrotum; thence on up the cords, and into the tissues around the groin, and thence, sometimes, upon the abdomen. In this form, frequently accompanied as it is by bruises and ecchymoses, the patient has very rapid and intense symptoms; cannot keep about; has to give up; is prostrated by the affection. High fever and violent sweats prevail also; and the patient passes very little, if any, water by the natural passages; whereas in the other affection he passes a good deal. Urinary retention takes place. The bladder becomes more and more filled and distended. The ureters pour it into the bladder faster than it can be extravasated into the tissues; consequently, the abdomen becomes large and tender, and all the symptoms are intense. This patient, after a day or two of misery, has to seek the hospital, where a severe operation has to be done. This form, if not relieved, is very dangerous. I do not say it would be necessarily fatal. It would not be in every case, for we see some patients who have gone through the natural history of the disease without dying. In this case, nature makes numerous openings for the escape of the urine, and the patient's life is spared at the expense of a perineum and scrotum filled with urinary fistulæ, through which urine passes almost like a colander, none escaping by the urethra.

These patients continue several years in this condition if not relieved; and the thighs, scrotum and parts about the perineum become riddled with long sinuses, looking a good deal like the sinuses of old hip disease; one heals a little while, another bursts open; and there is constant leaking of urine through them. I mention this to prove that nature does relieve this condition. The patient does not usually die of retention, nor of sloughing nor sepsis, but recovers, after a fashion, with these extreme discomforts. None the less important is it to make early openings to restore the natural passage to the bladder, and get rid of all these abscesses as speedily as we can. The scrotum is very apt to slough, the testes to be exposed, but even then they do not perish. They catch on with granulations, and frequently cover, after a while, by a spontaneous process of nature, in the most surprising manner.

On the other hand, there is also one other form of urinary extravasation which is rapidly fatal, and that is inside the pelvis. In that case the patient has met with fracture of the pelvis, some extreme crushing force, a blow which has ruptured the neck of the bladder, or torn behind the triangular ligament. When this extravasation takes place within the pelvis, it must be behind the anterior layer of the triangular ligament, and usually it is the neck of the bladder which is torn. In this case no urine can be passed. Intense pain and burning come on in the lower part of the abdomen. The patient makes frequent and fruitless efforts to pass water, straining violently. If he succeeds in passing anything, it is a drop or two of blood from the meatus. Nothing appears externally, except the fact that he has had a bruise, or fracture. Meanwhile, rapid symptoms of pelvic cellulitis and peritonitis come on; and, unless relieved, the patient per-

ishes in about thirty-six to forty-eight hours, with a rapid inflammation of the peritoneal surfaces. In this case the urine is extravasated behind the triangular ligament into the tissues of the pelvis; runs about more or less; affects the retro-peritoneal spaces; may affect the peritoneum itself; and, at any rate, gives rise to intense inflammation.

This condition of things calls for relief, if possible. Nowadays it is quite justifiable to attempt to secure the wounded bladder, usually by an incision over the pubes, so that it may be managed, and seen to. Sometimes, however, if proof can be got that the rupture is close to the neck, and nowhere else, it is wiser to attack it by the route through the perineum. But if there is evidence of great extravasation going on, then the pelvis and the bladder are surely ruptured, and perhaps it is wiser to make the opening over the pubes instead. Now it has always seemed to me, that in many of these cases where we open over the pubes, it would be well to open through the perineum also. It gives us the best possible drainage, and can do no possible harm; and both operations are quite justifiable in this extreme class of cases. I believe if both these operations were used early in these cases, that most of the lives would be saved.

No more terrible accident can happen, I think, to a young person than falling astride of some hard substance, and rupturing the urethra in some part of its course between the bulb and the neck of the bladder, in the membranous portion. This happens occasionally to sailors in coming down from aloft and striking upon a stay. It has happened to persons getting out of a wagon over a wheel. It happens also in a great variety of ways where people happen to come astride of hard objects. The object must be firm

and small to hit on the urethra, between the legs, in the perineum; and the rupture is immediately followed by minute extravasation; goes on slowly, like the one we described in the first instance. This gives rise to an abscess, abscess to operation, operation to direct inlet to the bladder, and, subsequently, to attempts to secure the urethra. This form of rupture gives rise to the most intractable and obstinate form of stricture, about the worst you can treat. It may be impossible to know that the urethra is accurately matched. It may never be accurately matched. The calibre is diminished, and this tends to contract like a string around the urethra; so that the patients frequently come back to the hospital after several successive operations, which have done a great deal of good, to have them repeated over again, to have a new perineal section done, or a new dilatation. Once get a fair channel in through the natural passages, of course the patient's only safety is the frequent passage of bougies, afterwards. Children and hospital patients frequently neglect themselves, and the trouble recurs over and over again.

Retention of Urine. — That is a fruitful source of trouble. It is frequently overlooked. The reason that it is overlooked is this: the bladder at first resents very much being stretched beyond its normal capacity by urine. The patient, however, if he has an organic or even a spasmodic stricture, may be unable to pass water, and the urine gradually accumulates, until, when it gets beyond a quart, it becomes intensely painful, and the patient makes violent efforts to pass it. Not succeeding, however, after a while the pain subsides, and the bladder becomes non-sensitive, and, as it were, paralyzed, distended. The bladder does not burst; but having reached the extreme limit of distention, the sphinc-

ter at the mouth of the bladder gives way, and leaking takes place. The patient begins to overflow; and there is a constant dribbling of a few drops going on through the urethra, which is sufficient to keep the bladder so full and no fuller, and to prevent rupture by overdistention. In this condition of things, the patient, who is careless about himself, may imagine that he has been relieved, and does not require anything more. The physician sometimes is deceived, because in the old patient it may be said that he has some form of paralysis, and his water is running away from him all the time; whereas really he has got from one to three pints of water in the bladder all the time, and only the overflow is passing off. That is especially true of old people, and of those who have had various forms of depressing disease. Of course, I need not say to you what is probably insisted on in all the other courses on treating acute diseases, that strict attention to the emptying of the bladder is one of the fundamental rules in treating all forms of acute disease. That should be inquired about and watched every day.

If the patient with typhoid fever, for instance, is indifferent; and lying on his back; and has not a distended abdomen; and on percussing over the pubes you do not get any particular dulness; that does not prove that the bladder is empty. It only proves that the bladder is not distended above the brim of the pelvis. If you reflect on the situation of the bladder in the pelvis, when the rectum is empty, a great deal of room is afforded to hold water without appearing much above the brim of the pelvis. So many times have I been, and have seen others, deceived in this way, when there was found to be sixteen to twenty ounces of urine lying concealed in the pelvis. So that in these cases of delirium, or dementia, or stupor, or fever, or

injuries, strict knowledge must be obtained that the bladder is empty; because it insidiously fills; dilates; loses its power; and repeated instances of inflammation of the bladder have occurred simply from the fact that distention has not been recognized. Dribbling, running away of urine, should make you suspect that there was a great body of urine behind. This would not be true, of course, of the true paralytic, where there is paraplegia; or in very old people in certain stages of low disease; but in ordinary cases, it is wiser to have a catheter passed at once, and be sure the bladder is empty.

What harm does urine do if it does lie there, provided a sufficient quantity is passed off by dribbling to prevent intense stretching of the bladder? By decomposition, and the decomposition of salts, especially the phosphates; and gradually by the urine becoming extremely ammoniacal, and finally irritating the bladder, so that the mucous coat throws off great quantities of mucus to relieve the irritation. This finally decomposes in the alkaline urine and turns into pus; and we have chronic inflammation of the bladder, with purulent catarrh, established.

The treatment of inflammation of the bladder is naturally divided into two parts, according as it is acute or chronic. The bladder may be acutely inflamed from some sudden cause, as sudden retention, or abuse of alcohol, or sudden exposure to great cold, or the metastatic effect of some other disease going on in the body.

The symptoms of acute inflammation of the bladder are so marked that any one can scarcely overlook them. There is a great deal of pain, a constant effort to pass urine. The urine scalds and burns terribly in passing. The patient makes a great many efforts to pass it spasmodically. It comes in a

few drops and stops With this there is the same straining produced in the rectum as in the bladder. The rectum is irritated and mucus extruded. The mucous lining of the rectum is forced down; and the patient is passing his time on the stool trying to pass water, and appearing as if trying to have an operation from the bowels.

This condition of things calls for gentle catheterization, and for active treatment to subdue the inflammation. Sometimes leeches to the perineum, about the prostatic region, are useful; hot fomentations are frequently very useful. A large amount of diluent drinks of a character to soothe the irritation; mucilaginous drinks should be given; and opium administered by the rectum. We have the opium absorbed directly from the rectum in and about the base of the bladder; and in the form of a suppository, or enema of hot starch and laudanum, it does a great deal of good in quieting the irritation.

This disease is short. In three or four days it is over, and the patient then is gradually relieved. It requires active treatment; but the chronic inflammation of the bladder, which is marked by ammoniacal urine, retention of urine, formation of pus, etc., is much more tiresome to treat; and years in getting well, frequently; if it does get well. In this condition, it is very important to draw off what is called the residual urine, and then wash out the bladder with a solution of boracic acid, which seems to be about as good as anything, and which can be done very readily through the penis, even with an ordinary catheter; or, if we wish, we can have a catheter with a double current. The caution to be observed is never to let enough flow into the bladder to distress the patient. Stop short of distress; and about four ounces is the limit. It should be

warm, and allowed to flow in very gently through a bag, or fountain syringe. As soon as about four ounces have flowed in it should be allowed to flow out, and be repeated over and over again, until the fluid comes back perfectly clear; and this to be done at least twice a day. No agent, I think, is so useful to give internally in these cases as boracic acid, finely pulverized, about twenty grains, two or three times a day. It frequently will clear up the urine without any other treatment; and seems to have a direct action upon this irritation in the bladder. In old cases of chronic catarrh of the bladder, without much pain, the old-fashioned remedy of balsam of copaiba is extremely useful; has as good an effect as in inflammations of the urethra, especially in old people with cystitis; and it seems to bring about very good results; here, also, we use boracic acid, and washing out the bladder.

There is one caution to be observed about drawing off the urine in a case of old retention. Bear in mind that the bladder has been accustomed to be distended a good while. If you then pass a catheter and succeed in drawing off the water, and draw it all off, pain is brought on. The bladder contracts violently. Its wall easily bleeds. Hæmorrhage takes place into the bladder, and more irritation is set up than is necessary; hence some urine had better be left in the bladder, and catheterization repeated. Then, of course, if we wash out the bladder gently with about four ounces at a time, we keep it slightly full of fluid; and we can wash out the remains of the urine with the injection we use. Quite severe symptoms have been sometimes produced, in cases of chronic retention, by drawing off one or two quarts from the bladder at once. If the bladder has been distended a good while it is not good treatment; although one is

strongly tempted to empty absolutely, yet it is not good treatment, and repeated catheterizations are much the safer course.

When the male gets beyond fifty years of age, he, as a rule, begins to experience slowness and difficulty in passing water; more frequent calls and slowness. That is not universal, but in the large proportion of people it is the rule. In almost every case, this slowness in passing water is due to a thickening of the prostate gland, which guards the neck of the bladder. This may be very slight at first; but it interferes with the prompt action of the accelerator urinæ fibres, and the urine flows more slowly. The reason why the patient has to go more frequently is usually because, owing to this condition of things, he does not completely empty the bladder at any one effort. He thinks he does; but a little remains in the fundus of the bladder, behind the prostate. That soon accumulates an ounce or more, and gives rise to a new call.

In the child the prostate gland is rudimentary; and if we cut for stone in the child, and expect to guide ourselves at all by the limits of the prostate gland, having the idea in our minds that we must not cut beyond those limits, we shall be entirely led astray, because the prostate gland, as such, is purely rudimentary in the child. After puberty, it begins to develop to a marked degree; retains its size until middle life; and then begins, as a rule, to slowly enlarge. If it happens to enlarge symmetrically, it does not do any great harm beyond making, perhaps, a little slowness and disability in passing water in old age; but, unfortunately, the prostate gland is not a gland as such, and is made up of a series of glands interlaced with fibrous tissue. This tissue develops into what might be called fibrous tumors. The

isthmus, or union of the two halves of the prostate gland, especially, develops into a fibrous growth, sometimes forming what is called a bar across from one side of the gland to the other; and in that way frequently impeding the passage of the urine, and catching the catheter; and in other cases forming an absolute lobe, which projects up into the back portion of the urethra as it enters the bladder, and obstructs the flow of urine, and acts almost as a valve. This is a positively morbid condition; that is, although it comes on in many, yet it is an abnormal growth of tissue in an unfortunate place, just as much so as a tumor would be. The result of this enlargement or development of the prostate gland is also to lengthen the urethra very much; so that the distance from the meatus urinarius to the bladder, in one of these prostatic cases, is at least one-third to three-fourths of an inch greater, according to the size of the prostate, than in the same individual in a perfectly normal condition. In addition to the length increasing so much, it also alters the natural curve of the canal. A short-curve catheter cannot get in; hence the necessity of using what is called a prostatic curve, which has a very long sweep; a catheter made about an inch longer than the ordinary instrument. Where this fails, we have, fortunately, another resource, which generally succeeds, in the perfectly soft catheter, which is made of soft rubber; and that is slowly passed into the meatus and down through the passages without force. This form of catheter has no resisting power, no stilette. It is like passing a rubber tube into the bladder. It is smooth, and will not irritate. It is oiled very perfectly, and slowly rotated down. Frequently the patient can pass it best himself; and after a while it will coax its way up over the third lobe in a way the solid catheter will not do. Since the

introduction of this soft catheter a great resource has been added to our treatment of chronic prostatitis; because the patient is thus enabled frequently to use a harmless instrument, whereas the elastic catheter with a stilette, or the metallic catheter, is liable to wound and bruise some portion of the prostatic tumor; to lead, perhaps, to a false passage; and, at any rate, frequently to fail in getting into the bladder.

It is very difficult sometimes to tie securely a catheter in the bladder in these cases. Of course, you can pass a large, long, curved silver catheter into the bladder, and that, with tapes and plaster, will stay; but the elastic one that is passed in and fastened, after the stilette is withdrawn, although for a few hours it does very well, is finally thrown out by the muscles of the bladder and urethra; and you will be quite surprised to find that this not infrequently takes place after the patient gets asleep at night, and perhaps a partial erection occurs; and the catheter has to be re-introduced the next morning. I alluded to this because it is not mentioned often, and it is a thing we have got to look out for all the time.

Now, in these cases of enlarged prostate in old people, all the symptoms are produced, finally, which occur in chronic retention. In other words, you have got a bladder which is incapable of emptying itself completely. The reason it is so is because it has a large tumor at its mouth instead of the ordinary prostatic gland. When distention becomes sufficient to bring on a powerful extrusive effort of the bladder, a portion of the fluid is poured out. A considerable quantity is accumulating at the fundus of the bladder, behind the bar, or third lobe of the prostate. There it speedily decomposes, and gives rise gradually to symptoms of chronic cystitis; so

that chronic inflammation of the prostate speedily follows this hypertrophy of the prostate, and then inflammation of the bladder; and then the patient begins to suffer much, making frequent efforts at straining, and never succeeding, probably, in emptying the bladder, or the pus that accumulates there. Moreover, you may be deceived by his story, and in watching the urine he passes; for it is only once in twenty-four hours, perhaps, that the pus which accumulates passes. I have been struck with the fact that these patients will pass water, and pass only the surface. The pus, which is in a thick, creamy layer, is resting on the fundus of the bladder; and does not get emptied by the urethra. If this patient is catheterized, the true condition of things will be found; and this is a very lamentable state of things, and frequently the commencement of a fatal change. The patient who has had chronic enlargement of the prostate, and whose bladder begins to get thoroughly out of order, with incessant calls to pass water, and chronic cystitis, frequently degenerates fast; and often dies, after a few weeks of great suffering. The attempts at passing water are incessant; the patient, perhaps, waking every half-hour at night, and making straining efforts and passing a few drops.

The correct treatment is catheterization with a soft catheter; to wash out the bladder; following this up with great regularity at least once in twelve, or eight hours. If this is done carefully, the last thing at night; if the bladder is emptied and washed out; the patient almost invariably gets some hours of good sleep before demand for urination comes. Then it should be done again in the morning; and, possibly in bad cases, once again in the afternoon. The patient should be taught to pass the catheter himself; and an intelligent assistant frequently can take the place of the

doctor in assisting to pass the soft catheter and washing out the bladder; which can be done with ease if a little care and patience are used. In addition to this, also, it is, of course, very important that the state of the bowels should be attended to; that the rectum should be kept free from hard masses, and the patient's general health kept up.

Sometimes this condition of things becomes so unbearable that two other modes of operation have been devised, and sometimes consented to by the patient, to relieve the chronic enlargement of the prostate. One is to make a permanent opening through the perineum, and allow the patient to pass water through the perineum. It is thus impossible for pus to accumulate. It has to run out; and we have a ready means of washing out the bladder and keeping it in a healthy condition. If the patient is willing to have this done, it may save life. Generally, they prefer to try other things. The other mode of operation, which is more modern, and which has been, I believe, reasonably successful, is to open through the perineum, or sometimes over the pubes, and remove the third lobe by curetting, or cutting off, either with the écraseur, or wire, or curette, as the case may be; and to re-open, so to speak, the normal passage through the prostate, by destroying this valve which lies at the outlet of the bladder. This is more of an operation; entails some risk; but has been reasonably successful where it has been done.[1]

There occasionally occurs such a thing as acute inflammation of the prostate gland, followed by abscess. This is rapid, and the symptoms intense. At first they are those of ordinary acute inflammation of the bladder; terrible straining and tenesmus; fever, sweats, etc. Then, if examination is made by the rectum with the finger (which ought always

[1] Castration is now proposed.

to be done in these cases of suspected prostatic inflammation), it will be found, usually, that one lobe of the prostate is larger than the other; and hotter, sensibly so, to the finger; and very tender; and after two or three days, if examinations are repeated, it will be found to have softened; that is to say, you will find one lobe larger than the other, a little softer; and at one point, perhaps, you are conscious that it dimples under the finger. That means prostatic abscess. If left to itself, it will burst, and usually into the rectum. It is better to open it into the rectum, and have it drained off. The opening into the rectum, whether spontaneous or cut, closes again; and the patient is, in that way, relieved.

In very delicate young subjects, especially boys at all inclined to tubercle or scrofula, acute inflammation of the prostate sometimes follows violent forms of exercise, which press constantly upon the perineum, as prolonged bicycle-riding, or things of that kind. Of course, this does not occur in the average person.

Sometimes I have seen these abscesses come forward and present themselves at the perineum. In that case we open through the perineum, and wash out and drain. Usually, however, they either break, or are opened through the rectum.

Occasionally, in the case of an old man, you will find all the symptoms of chronic prostatitis and retention going on together, with evidently something more; that is to say, the patient tells you he has a great deal of pain in having a passage from the bowels; and evidently he is emaciated and suffering from some organic affection. If the usual examination is now made by the rectum with the finger, you not only feel an enormously enlarged prostate, but something quite

different in it; that is, lumps — hardened, irregular, and sometimes almost of stony hardness. This disease is *cancer of the prostate.* Now you can easily distinguish this from cancer of the rectum, from the fact that it is strictly limited to the prostate, and does not involve the mucous membrane of the rectum at all. The mucous membrane can be slipped about over it on the finger; but deep in, beyond that, on the prostatic surface, is felt this series of indurations, which are scirrhus; hard, stony indurations of the prostate gland. This condition, I presume, is irremediable.

Rarely in young people, occasionally in old people, you have tubercle of the prostate. In this case the tubercle frequently goes farther, involves the kidneys, and a fatal result follows after some time.

XXXIII.

STONE IN THE BLADDER.

You know, of course, that stones are formed from deposition of the salts of the urine which are not held in solution, but which deposit and crystallize. That may take place in the kidney, frequently does. It may take place also in the bladder. Usually it takes place in the bladder. The patient has a history of what is called an attack of gravel; passing a little calculus through the ureter into the bladder. After it drops into the bladder, the pain ceases. If he is fortunate, he, in a day or two perhaps, passes it off through the urethra, and feels it scrape as it passes, or hears it strike as it is ejected. But frequently, after the attack is over, and it passes into the bladder, he thinks no more of it. It remains there. This little calculus speedily becomes a nucleus for attracting crystals which form upon it; and they may be of any kind, but usually the core or centre of the stone is of uric acid and the surface of phosphates. The phosphates deposit much more rapidly than uric acid. The uric-acid part of the stone is generally small, but the shell is usually very large, and soft, and friable, and of rapid formation. Occasionally, also, in the dyspeptic and feeble person, who is subject to the oxaluric diathesis, the oxalate of lime deposits in the bladder, and the formation of stone, what is called the mulberry calculus, goes on; it resembles the mulberry in its shape and projections. This stone is the most dense and heaviest of all; and usually occasions the most intense

suffering. The stone covered with phosphates will be tolerated in the bladder a good while, because it is not very rough; but the mulberry calculus is intensely painful, from the projections and from the weight.

Hereditary influence is thought by most to have an influence in the production of stone. Of course, we suppose that the habits of the patient and the drinking-water of certain localities have an influence also; but it is a singular fact that the tendency to the formation of stone descends in a great many families, just as the gouty diathesis descends.

The deposition of uric acid, especially, seems to be due to some defect in digestion; and is really a diathesis in the constitution of the individual.

The three forms of stone, which are the oxalate of lime, the phosphate of lime, and the uric acid, if they can be diagnosticated, or the person's diathesis can be diagnosticated, require different modes of constitutional treatment. The alkalies, in various forms, have the most influence in holding uric acid in solution, and also the salts of lithia have that power. On the other hand, benzoic acid seems to have the most power in keeping the phosphates solvent; and the mineral acids have quite an effect on the oxalate of lime. No remedy is known which is a cure for stone; but certain classes of remedies have a tendency to prevent the deposition of crystals rapidly.

Stone in the bladder may occur at any age, frequently comes on in little babies, in children, and also up to old age.

The symptoms are generally pretty well marked, though they vary in intensity. The patient is pretty sure to be uncomfortable if he is jarred. That is rather characteristic of stone. If he rides in a rough vehicle, or steps down an

unexpected step in the dark, or has a sudden jar, he feels it. Moreover, in very many patients, any prolonged exercise is followed by the passage of a few drops of blood. This hæmaturia, in the absence of any other form of hæmorrhage, is quite characteristic of stone. The patient may tell you that through the night, or when sitting about, he never has any blood pass by the urethra; but if he takes a walk, or ride, and comes home, although he has not had pain, the first time he passes water a little blood comes. That should make you suspicious of some substance irritating the bladder and causing hæmorrhage. Not a great deal of stress, I think, need be laid upon that symptom which has been made so much of: the stopping of the stream of water in passing. There are so many other things that will do the same; for instance, enlargement of the prostate, or simple spasm of the muscular fibres of the urethra, especially towards the close of urination, causing an interruption of the stream in many people who do not have stone, that I do not think that symptom is of so much importance. Frequency in passing water; slight pain in passing water; occasionally a few drops of blood; pain on motion and jarring; seem to be the most characteristic symptoms of stone.

You will not get much history or many symptoms out of a little child; and the disease has to be found out by watching him; finding he is constantly going to pass water; and then, of course, the diagnosis can be readily made with the sound, which ought to be used, as a diagnostic measure. When the patient is sounded for stone, it is better to have some water in the bladder. Usually it is sufficient to ask the patient to retain his water two hours without passing it. When the stone is struck by a metallic instrument, it

generally is at the very moment the catheter or sound enters the bladder; as soon as we have rounded the curve. It almost always lies behind the prostate gland; and generally it is struck by the beak of the instrument the moment we enter the bladder. The little sound invented by Sir Henry Thompson is the most useful to explore the fundus of the bladder. It is easily passed, with a little care and gentleness; and then if you do not strike the stone, you invert it, and have the little blunt point downwards, which can be pushed about over the base of the bladder. If that does not succeed, then if the finger of the other hand is at the same time passed into the rectum and moved about, we can almost certainly detect it. Alteration in the position of the patient will frequently assist us. That dislodges the stone, and it rolls back into the fundus and is struck.

The sensation of portions of the bladder is sometimes mistaken for stone, even by experienced persons. In the old, inflamed bladder the walls are thrown up into little fibres and folds; and they frequently have little portions of sand deposited in these folds; a sort of a sandy condition of the walls, like little deposits of mortar. As the catheter scrapes about over these, we may mistake them for stone. Sometimes the boundaries of the pelvis may be mistaken for stone. The true feeling and sound of stone is very distinct. Sometimes it can be heard as a distinct click; and, almost always, the stone is movable, and can be felt to roll about.

You, no doubt, are familiar with the great improvement in searching for stone, where a small stone exists or where you are in great doubt, by passing in the evacuator of Dr. Bigelow; when, after pumping, frequently a small stone will strike against the mouth of the tube, in such a way that

you cannot mistake its presence. Usually, however, stones are found by sounding in the ordinary way; and the great points are, if the patient is very sensitive, to have him etherized; to have about three or four ounces of some fluid in the bladder; to have an instrument you can invert to examine the base of the bladder; and to exercise patience and gentleness.

There are generally accepted two methods to get rid of stone: one to cut into the bladder and take it out whole; and the other, by the urinary passages, crushing and taking it out piecemeal.

The operation of lithotomy in all the early days was solely practised. Some time in this century lithotrity was introduced, and carried to success by Civiale, of Paris.

The operation of lithotomy, or cutting for stone, in itself is not very fatal. When the lateral operation was introduced in 1697, and afterwards perfected by Chesselden, of England, who was perhaps the greatest lithotomist of all times, he attained such success, a century or a century and a half ago, without antiseptic methods, that he numbered but ten deaths out of two hundred and thirteen cases; I think no one could show a better record at any later day; and it is almost equal to the record which can be shown by the most improved methods of modern crushing and extraction.

As this subject was investigated, it was found with regard to mortality, that it varied very much with the age of the patient. I will give you very briefly the results: in children, .04 per cent.; in patients over sixty years, 27 per cent. So that you will see, as age goes on, the operation of cutting becomes progressively more fatal; and in the child the mortality is barely over five or six per cent.; and this in spite of

the fact, that the structures to be gone through are so rudimentary in the child, that a prostate practically does not exist; and the position of the bladder itself, being entirely different in childhood, being high up behind the pubes, and much more difficult to reach by a cutting operation, yet, in spite of that, the mortality is extremely small.

In the earliest times at which cutting for stone was done, in the Middle Ages, the operation was performed in a very simple manner, with a fair amount of success, though with the result of great mutilation. The method consisted in operating without any staff whatever. It would seem to be applicable to only pretty good-sized stones. The surgeon dilated the sphincter ani; passed two or three fingers up beyond the prostate; dragged the prostate and base of the bladder, and presumably the stone, down on his fingers towards the perineum, and cutting directly through the perineum, sphincter and all, until he had opened the rectum and bladder, extracted the stone. No subsequent treatment was used to close the wound; and the records of recovery were good. Rectal fistula was said to be not very common after this operation; and the rectum was said to recover very fairly its power.

A much more delicate and scientific operation was the median operation of lithotomy, which would seem to be still, for small stones in children, sometimes the very best method. This consisted in getting a curved sound into the bladder, and making an incision in the median line, down between the bulb and membranous urethra; opening the urethra, and extracting the stone by dilating the prostatic urethra.

This, however, was not applicable to large stones. They could not be got out through so small a wound.

The next advance was to the operation usually done nowadays, in the great majority of cases, and which is called the lateral. In that case a curved staff is put into the bladder. The primary incision is the same as in ordinary perineal section; but after the knife has reached the staff, then the staff is depressed, the blade slid on into the prostate and turned at an angle towards the tuberosity of the ischium, so that the prostate, instead of being divided antero-posteriorly, is divided through one or the other of its lateral lobes; preferably, if the operator be right-handed, through the left lobe. As the surgeon withdraws the knife, he cuts through the tissues of the perineum, between the perineal centre and the tuberosity, outwards; making a very dependent wound. In this way lateral lithotomy gives a very large opening. Subsequently the wound in the prostate can be best dilated with the finger and stretched; and a large stone can be extracted in this way.

The modifications of the operation about this region are hardly worth considering here. They are such as would occur to any surgeon at the moment of operation. Double, or bilateral section has sometimes been required, because the stone could not be extracted through a single cut. Obviously this second cut is easy. In the same way, various names have been given to complicated operations, like medio-lateral lithotomy. That means simply that the operator makes his perineal section in the middle line, follows in on the sound, makes a little vertical cut in the prostate, finds it insufficient to extract the stone, and then passing the finger in, cuts the prostate on the side, dilates, and withdraws the stone through the median line.

The more important points in the operation of lithotomy are these: In the first place, it is never considered justi-

fiable to operate at all unless you have struck the stone with the staff. Previous soundings may have been deceptive. It is considered a cardinal rule that the stone should be touched at the moment of operation; and when the curved staff is introduced into the bladder, and the stone can be found, then the operation can be properly proceeded with. It is obviously much easier to operate in a bladder which is partially distended with fluid; so it is customary to draw off the urine and fill the bladder partially, with four to six ounces of a warm solution of boracic acid, or something of that kind, which is irrigated in through the catheter in the urethra. Subsequently, while the patient is etherized, it will be found that the curved staff affords an unfortunate channel through which this fluid is liable to flow out before the surgeon wishes; and it is therefore sometimes necessary that the staff should be grasped around the root of the penis; or that an elastic rubber band be passed around, and the urethra thus occluded on the grooved staff. Thus, above the scrotum, is the elastic; and it is sometimes a very good expedient to keep the bladder full, until the surgeon gets ready to puncture through the prostate. It is very important that the staff be committed to a person who will hold it stiff; and in order to hold it strictly in the median line, it is customary to pass it into the bladder, draw it up under the pubes, and hook it there, in the median line.

As to subsequent treatment: The essential thing seems to be to fasten a large elastic catheter through this perineal opening in the bladder, for one or two days. In the child it is hardly necessary to put one in at all; and the urine flows out, usually, through the wound, without making any trouble. It is desirable, after extracting the stone, to search the bladder thoroughly, to see that no

others are concealed in it; to wash it out thoroughly, and insert a large catheter, which is fastened in.

Various mishaps have happened. Sometimes the bladder is not reached. Sometimes the rectum is wounded. Sometimes there is trouble from hæmorrhage. Trouble from hæmorrhage is likely to arise from the large branches of the internal pudic artery. This hæmorrhage is extremely difficult to check. It is best done, probably, with the old-fashioned aneurism needle, or by a curved needle in a handle, by which a stitch can be taken around the artery. If the hæmorrhage is such that the vessels cannot be reached and tied, then we can pack the wound. You cannot pack the wound, of course, unless you leave an adequate flow for the urine; and for this a large silver tube, called a *cathéter à chemise*, is devised, around which the packing is put. The tube goes into the bladder and lets the urine flow. That is usually perfectly effectual, and can be kept in twenty-four hours, when the chance of hæmorrhage ceases. When the operation is fatal, it is usually so either by septic processes, or else by some sudden shock given to the renal circulation, so that it is checked, and the urine is suppressed. A chill after the operation, in twenty-four to thirty-six hours, is a very bad sign. Great care should be then taken that the flow of urine is free; that the bladder is freely washed out; and I suppose that we are comparatively powerless to check the further mischief. Possibly dry or wet cupping over the kidneys; the giving of strong diuretics and diaphoretics, might be of some use; but when this change takes place, the patient usually perishes in a few hours from suppression, with symptoms of coma and collapse. But the average results from lithotomy are very excellent indeed.

The advantage of this operation, when it succeeds, over

any other operation, like crushing, is that it leaves the bladder free and empty and unirritated; affords a perfect and ready transit for the urine through the tube; and the bladder is thoroughly cleaned and washed out. If the patient has carried a stone a good while and there has been a good deal of irritation of the bladder; and especially if cystitis is present, and constant straining and the passage of mucus and pus; and the patient at a somewhat advanced age; I am inclined to think the operation of lithotomy, in such cases, is preferable to lithotrity. These patients, by this operation, have produced at once that sort of physiological rest of the bladder we seek to produce in obstinate cases of cystitis by making a permanent opening, and allowing the urine to flow out; and rendering it impossible for phosphates and pus to accumulate. We accomplish this by lithotomy; and in these cases this would seem to be the most philosophical operation.

The operation of lithotrity is done without mutilation and without cutting. It is not done I fancy, however, without some tearing and bleeding of the deeper parts of the urethra from the very large size of the tubes which have to be used. Moreover, it is extremely important that every particle of sand and gravel should be got out of the bladder at the time of the operation, in order to leave it at ease, so to speak, just as it is after the operation of lithotomy.

The modern operations of lithotrity are distinguished from the older ones by the very great improvements, introduced by Dr. Bigelow, to complete the operation at one sitting. In the former operations of lithotrity, the surgeon being timid about the tolerance of the bladder, was unwilling to prolong the operation beyond three or four minutes; therefore, the lithotrite was carefully introduced, the stone

seized and crushed a few times as rapidly as possible, and the operation considered closed for that day. Subsequently the patient had a good deal of pain and tenesmus; passed off some of the small fragments, but could not the larger ones; and, after four or five days, the operation was resumed. Sometimes four, or five, or six of these operations had to be done in succession, consuming ten to fourteen days, before the bladder was finally emptied.

The great point about the modern operation is that everything is done at one session. That session may consume from one-half to one hour or more; but it aims to leave the bladder free and empty. This has only been accomplished by having found out two points: one is that the urethra will admit a tube very much larger than was formerly thought, through which considerable fragments can be washed out by pumping; and the other point is, that the bladder, provided it is left clean, will tolerate a great amount of handling, in crushing fragments, washing out and pumping, without serious detriment to the patient.

In this form of operation, in favorable cases, the mortality has been reduced extremely low (.06 per cent. lower than by lithotomy); and it is applicable to almost every case; being limited somewhat in its application by an enlarged prostate, by a chronic cystitis, by an old stricture with a very narrow urethra; and also limited in its use, it seems to me, in children, where lithotomy is so safe and simple that it really seems to be the preferable operation to that of lithotrity. The size and the hardness of the stone, and the ability to crush it easily into fragments, also are important factors as to which operation should be chosen; and although the more modern instrument Dr. Bigelow completed before his death, and used with such success, will crush almost everything, yet

it is a laborious and tiresome operation, and one involving some risk from the pressure used in attempting to crush a large mulberry calculus in an irritable bladder.

It is said that the operation of lithotomy leaves certain chances of impairment of the parts, which are not left by the operation of lithotrity. I think this is true. The chances are not very great, but they are something after lithotomy, that a section through the prostate, and near the ejaculatory ducts of the vesiculæ seminales, may impair subsequently the virile power of the patient, by obstructing, more or less, the ducts by the scar which finally results. The chances of a permanent perineal fistula are small. The chances of troublesome stricture after lithotomy are extremely small. We have the ordinary risks, however, of any cutting operation; and we can balance against them the risks, in some patients, of a prolonged lithotrity with cystitis and enlarged prostate. The surgeon can judge pretty well by frequent analyses of water of the patient, by his history and age, by the general feel and size of the stone, etc., what sort of a stone he has got to attack; and he may, if he wishes to do so, preface his operation by passing the lithotrite, measuring the stone, then trying to crush it; and if that goes well, he can proceed with the operation of rapid lithotrity and evacuation; but if that fails, this is no obstacle to his doing the operation of lithotomy. He has only to withdraw the lithotrite, insert the staff, and proceed in the ordinary way.

HÆMATURIA.

There is a condition which sometimes calls for surgical interference, at any rate is very important as a diagnostic point, and that is the existence of hæmaturia in some patients. One can generally make out pretty accurately

where the blood comes from by the mode in which it passes from the urethra and escapes from the body. Blood which is poured out in the kidneys and trickles down through the ureters into the bladder mixes with the urine and gives rise to smoky, high-colored urine, which can be detected by the microscope. On the other hand, where hæmorrhage takes place very slowly from the kidneys, and the blood has time to set in the ureters, attacks are produced very similar to gravel; and the clots are finally expelled into the bladder, and evacuated in a form and shape exactly like casts of the ureter. That indicates that the source of blood is probably in the pelvis of the kidney.

When, on the other hand, the patient passes considerable clots of irregular size with the urine, we may be pretty sure that the hæmorrhage is from something within the bladder, and usually from a congested state of the mucous membrane; possibly from cancerous or villous growths; sometimes from old abscess and inflammation about the prostate; whereas when the blood passes free and fresh from the urethra, and is not mixed with the urine, and not coagulated, it is almost sure to have its source somewhere in the urethra itself. These little distinctions are very important as guides, which are reasonably invariable, as to the source of the hæmorrhage.

Hæmorrhage which takes place in the kidney, or appears in the form of casts of the ureters, obviously can be best treated by medical means; by the giving of ergot and gallic acid, etc. It frequently can be remedied. Hæmorrhage which takes place in the bladder, with the formation of coagula, requires different treatment: that the bladder be evacuated at regular intervals, and thoroughly washed out with some fluid, so that coagula shall not be allowed to form

long. After forced catheterization, spasmodic strictures with the unfortunate formation of a false passage, or of any traumatic injury which has caused hæmorrhage into the bladder, sometimes clots form in the bladder of considerable size, and we try in vain to get the urine out. As fast as we insert this or that catheter, the moment the urine begins to flow a few drops rush out through the catheter, the next clot is sucked into the eye, and any further effort to get urine is defeated, until we take out the catheter and clean it. Various means may be used. The old authorities used to say, if you waited a little while, that the clots became a good deal softened and disintegrated in the urine of the bladder; and after a few hours, perhaps, the patient might be catheterized. If great distention and distress ensue, the easiest course is to aspirate over the pubes, and draw off the urine from time to time, until the clots do disintegrate.

Bleeding from the urethra itself is best checked by passing a large metal catheter and keeping it in the bladder, compressing the parts; or sometimes by applying the ice coil, or bag, to the perineum and about the bulb of the penis, in which way it is often very well arrested.

FLOATING KIDNEY.

This is a very curious affair. You are aware that the kidney, more or less covered by peritoneum, lies in a fossa of its own, tied down behind by very loose areolar tissue; it probably has some slight motion, influenced by the movements of the liver and the stomach and the intestines. As it lies loose in the body it occasionally becomes dislodged from its bed, usually as the result of fall or accident, and comes forward into the abdominal cavity, and may be felt as a tumor, anywhere between the sides of the body under the

ribs and the umbilicus; it sometimes gravitates down so that it is felt below the level of the anterior superior spine of the ilium. On the patient's assuming various positions, it will be found that the tumor changes place. If the patient lies on the back, the tumor will often disappear.

This is an annoying, but never, I think, a fatal affection. It produces sensations of dragging and weight; gives some pain; and is occasionally remedied by a surgical operation, which seeks to fasten the kidney up to its normal site by making an incision down to it and stitching it to the posterior part of the abdominal walls. These operations have been quite successful. As milder measures, an abdominal belt with a pad, and pressure, often suffice very well to make the patient comfortable, where an operation is not desirable.

PERINEPHRITIC ABSCESS.

Owing to looseness of this tissue around the kidney there would appear to be a special tendency in some cases for suppurative inflammation to be set up there; and abscess around the kidney, called sometimes perinephritic abscess, is not very uncommon. Perinephritic abscess preferably begins back in the loin, behind the kidney. In its simpler form it probably exists only as an abscess in the cellular tissue. It may burrow beneath the ribs in various directions. Its tendency is to burrow downwards into the pelvis, so that it becomes complicated with pelvic abscess, before the case is operated on. It may involve the capsule of the kidney, or the ureter, and break into the ureter, or pelvis of the kidney. In that case its presence may be suspected by the fact that the patient passes pus with the urine, although there are no symptoms whatever of cystitis, or inflammation of the bladder. Where it does not break into

the ureter, or discharge pus, it gives rise to swelling and pain in the flank.

The cases which have an opening into the urinary passages, and in this way have a vent for the flow of pus, are never so acute as those which are wholly retained. This forms a safety-valve, so to speak; and the abscess gradually sinks into the condition of ordinary, cold abscess, without much constitutional disturbance; without great pain; with occasional attacks of hectic and sweating; constant loss of pus and emaciation; but the tumor does not become of large size, and is not very easily reached.

Cases which have not emptied into the urinary passages, after a while produce intense symptoms of nausea, pain, emaciation; and finally distinct fulness of the flank, and eventually fluctuation; but they seldom break in that region. They sometimes gravitate down into the pelvis, and break into the vagina, or rectum. Usually the patient, if carefully examined, can be found to have a difference in the two flanks; one being quite easily compressed, and the other full and resistant. If the patient is turned on the two sides alternately, one flank hollows in and the other does not. Fluctuation may be in some cases detected. In these cases it is important to interfere, and operate by an opening into the loins. It is usually successful, when the operation can be done without opening the peritoneal cavity. The abscess is behind the peritoneum, and pushing out towards the muscles of the loins. The opening is made along the quadratus lumborum, and the deep fascia picked through, until we come down upon the abscess.

The great point is to get a very large and free opening, and to drain and wash out the cavity, if possible. If no very deep pockets are formed, and no leak into the urinary

passages, a good many of these cases are finally cured; but if there is a very deep pocket into the pelvis, it has to be drained up hill, so to speak, and the duration of the case is long; and sometimes nature, in these cases, makes a second opening into the rectum.

The cases leaking into the ureter are very much relieved by the external operation through the loins; but, as a rule, I do not think the urinary fistula is closed for a long while. It is in these cases, where the kidney or ureter has become finally involved, that it is justifiable, sometimes, to make a still larger opening behind, and endeavor to remove all the affected parts. This is a much more difficult operation than to operate on the kidney in its natural state; because you have adhesions, and a difficulty in finding the ureter. Although sometimes the operation is justifiable and successful, it is not so easy as removing the kidney in cases of more simple forms of disease.

These perinephritic abscesses come preferably in feeble and scrofulous, or tuberculous subjects; occasionally in consequence of violent exposures, such as, for instance, violent exposures to wet and cold about the abdomen and pelvis and back; and to great fatigue and sprains; although they are not liable to be formed in that way in the healthy individual, yet they do start as abscesses in the feeble individual, just as in the neck, or axilla, in subjects of the same class.

Early diagnosis, free openings, washings-out, endeavors to drain; these comprise the sum of treatment. If there is no urinary fistula, they will often get well. If there is, they are extremely slow to recover, if ever.

AFFECTIONS OF THE SCROTUM.

The scrotum is quite an obscure region on account of the various organs and diseases which exist in it. I will enumer-

ate very briefly certain things in the scrotum which are hard to tell one from the other; hydrocele and cystic disease resemble each other a good deal in the presence of fluctuation; ordinary inflammatory or gonorrhœal epididymitis and tubercular disease of the testis are very difficult to tell apart, sometimes. Hernia and varicocele are notoriously difficult to differentiate; also, cancer, or sarcoma of the testis, from orchitis or syphilis. These are the more common difficulties.

Affections of the Testis. — We will speak briefly of affections of the testis. One of the most annoying affections is

Neuralgia of the Testicle. — It is apparently a neuralgia of the spermatic nerve. It is diagnosticated by the fact that the cremaster muscle is thrown into violent contraction by the occurrence of the pain. The patient is seized with paroxysms of pain shooting down into the testicle, and the testicle retracts with great violence.

Of course, the first thing that would occur to one would be whether there were not some gravel in the ureter provoking the pain. But the frequency of the attack, the fact that the urine is normal, that the patient does not have those attacks of intense pain in the loin, and the vomiting, which accompany a discharge of gravel through the ureter, after a while will lead to the diagnosis of simple pain. It is a neuralgia of the testis. The retraction is violent and forcible. The testicle is drawn up to the ring. The patient suffers agonizing pain, and his life is rendered miserable.

The important point to be observed in these cases is that they are not proper subjects for surgical operation; although the patient will sometimes beseech you to remove the testis, it is not proper to do so, because there is no disease of the parts. You may as well extract all the teeth for facial neuralgia, although the teeth are sound. It is not proper

to remove the testis. Other measures must be tried. A suspensory bandage, the subcutaneous injection of morphia in the vicinity of the cremaster muscles, a vacation, care as to constipation, the application of narcotics to the testis itself, are sometimes of great help in overcoming this affection. The narcotics which seem to be the most effectual are opium in the various forms of salves, etc., and belladonna or stramonium; cocaine, perhaps, may do some good, if injected cautiously in the vicinity of the spermatic nerve.

Diagnosis is important. Treatment is important, inasmuch as you should not operate.

Tubercle of the Testis. — Tubercle of the testis is quite common in the tuberculous subject. It occurs preferably in the young person. When a young man comes with this affection for the first time to the surgeon, he finds the epididymis knotted and hard and tender; and his first thought is that this must be due to gonorrhœal affection of the epididymis. Frequently you ascertain that nothing of the kind has occurred; and the course of the disease, if you watch it long enough, will make the diagnosis certain. Acute epididymitis in its painful state is a matter of a week or two; it then becomes indolent, remains as a chronic induration without sensation, and without any change unless it slowly diminishes under treatment. Also, it is to be observed, that its onset is very acute. The patient, even though he may deny the occurrence of gonorrhœa, probably will not know enough to deny the questions you ask him, when you ask if there was intense pain when it came on, etc. That marks the onset of gonorrhœal epididymitis. The tuberculous testicle does not have a rapid onset. If it persists long enough, it almost always terminates in abscess. There is

a lumpy condition of the epididymis, with a soft spot here and there, precisely like the softening of cheesy glands in the neck. In many of these cases, finally, the abscess bursts; then drains away for a good while without pain, and then heals; then another forms. Sometimes sinuses remain a good while, sometimes not. This tubercular affection of the testis, perhaps, it is important to operate upon, if the patient is willing; and the operation of any benefit is to remove the testis, epididymis and all, and castrate upon that side.[1] It used to be said, and it is true, I think, that it is not justifiable to castrate on both sides in a case of double tubercular disease, because the function of the testis is often retained where we would not expect it to be. A portion of the gland may remain unaffected, and secrete and discharge its functions, in spite of very serious disease. The reason for removing the testis which is affected, on one side, is this, that like other tuberculous affections, being a focus of tubercular disease, it is apt to creep up, unless it is removed. To palliate tuberculosis of the epididymis it is sufficient to wear a suspensory bandage; cover the parts with some soothing ointment, and strengthen the patient with tonics, cod-liver oil, iron, quinine, remedies of that class. If repeated abscesses form; if you are sure of the diagnosis; if the disease is confined to one testis; it is a question whether it is wiser to remove the part, under the belief that, if it remains, it may infect other parts.

Syphilitic Testicle. — The syphilitic testicle is an entirely different affair in its feeling and growth. It is painless except from weight; a slow thickening of the parts; it preserves its shape; is smooth; looks like the normal testis, only large and heavy. The patient complains of

[1] Subsequent experience has rendered me less willing to operate.

the dragging on the cord. With a suspensory bandage he may be quite comfortable. It is a gummatous disease of the testis, with deposit of fibrous tissue. If taken early, and vigorously treated by specific measures, it is sometimes relieved. If seen late, there is no remedy except excision.

Sarcoma of the Testis. — Sarcoma of the testis is rather more common than cancer; and has a more rapid growth. Cancer is generally nodular. You will distinguish this easily from the enlargement of the epididymis, either in tubercle or inflammation. You find the cancer affects the body of the testis itself. The testis is enlarged; irregular; with projections; and portions of projecting material of various density. Next comes on a very early and serious sign in sarcoma or cancer of the testis, and that is thickening and enlargement of the cord, and the appearance of a lymphatic gland in the region of the external ring. Whenever the cord has begun to be thickened, you may be pretty sure a malignant disease is creeping up rapidly towards the pelvis and lumbar glands. We are liable to be deceived in the early stages of cancer and sarcoma of the testis by the fact, that while the disease is still small it frequently provokes a serous secretion in the tunica vaginalis. The patient comes with hydrocele. You tap, and it gives issue to the ordinary straw-colored serum. Look at the testis, and see whether it is healthy. If you find a nodule, that means cancer, or sarcoma, or cystic disease, which has provoked a secretion of serum into the tunica vaginalis.

The only remedy is excision; and the earlier it is done the better.

Cystic Disease of the Testis is deceptive, because it

imitates hydrocele; but, if you examine it carefully, you will find that although there may be a cyst with a good deal of fluid in it, still it is not perfectly symmetrical like the ordinary hydrocele of the tunica vaginalis. Hydrocele of the tunica vaginalis is strictly oval and pear-shaped; having the stem up the cord, and extending evenly down; and is rounded like an egg. Cystic disease of the testicle is irregular; fluctuates; it has a sac; and bulges in various directions. Tapping will give the diagnostic point. If you tap an ordinary hydrocele of the tunica vaginalis, you collapse the whole thing; and if you tap the cystic disease, you usually empty one large cyst, and find two or three little ones left. The fluid is gray-colored and opaque; and contains cholesterine, and sometimes dead spermatozoa, if carefully examined.

Cystic disease of the testicle is apparently incurable. It is not malignant; but it destroys the function of the testis, and is best treated by excision. You see the importance of making the diagnosis with regard to collections of fluid in the scrotum. Tap and see if the parts beneath are healthy. There may be a cyst of the testis, or sarcoma of the testis, provoking hydrocele.

Orchitis is an inflammatory affection, due usually to gonorrhœal inflammation; sometimes preceding epididymitis, but frequently coexisting with it. It is much more painful than epididymitis. The testicle swells uniformly, with intense pain. It will get well after a while; probably at the expense of a great deal of suffering. It is best relieved by a suspensory bandage, saline cathartics, etc., if you do not decide to do anything more radical. It is most speedily relieved by puncturing the tunica albuginea of the testis. The fluid is in under the sheath of the testis itself; and a

light puncture with a fine perforated needle, in two or three points, may be done with safety; and the letting off of pressure, just as in glaucoma of the eye, is immediately followed by relief of the pain, and amelioration of the symptoms.

Common **Hydrocele** of the **Tunica Vaginalis** is cured in several ways. By injecting irritating fluids; passing setons through the sac; by laying open the sac, draining the contents, packing with gauze, and forcing it to granulate up from the bottom. In old persons, I am in the habit of advising them to be tapped. It is perfectly harmless, is painless, is sufficient, can be repeated once in four to six months without trouble, without the patient's running any risk; and he does run some risk with radical operations on the scrotum. Erysipelatous affections sometimes come on. If a man is quite old and moderately infirm, I think the best advice to give him is to have his hydrocele tapped, and not to have it radically cured. In younger people the radical operation is very successful.

BOYLSTON PRIZE ESSAY FOR 1860.

THE VALUE AND THE FALLACY OF STATISTICS IN THE OBSERVATION OF DISEASE.

Perpendendæ, magis quam numerandæ, observationes.

" Je sais que la vérité est dans les choses, et non dans mon esprit qui les juge ; et que moins je mets du mien dans les jugements que j'en porte, plus je suis sur d'approcher de la vérité." —*Emile J. J. Rousseau.*

THIS saying of the sage of Geneva has been used as evidence for the value of statistics, but it contains, also, as it seems to us, the germ of their fallacy; since they tend, when carried too far, to separate reason from observation; to ignore the subjective, and to study only the objective, phenomena of disease. They would lead the medical observer to overlook, with Rousseau, the fact that it is by his mind that he judges, and that the rectitude of his decision depends on his own mental acuteness.

To adopt a clumsy but expressive phrase of Carlyle: "The eye sees only that which it has the power of seeing." Previous knowledge and particular training, as well as common-sense, are necessary to the correct observation of any class of phenomena. Observation must always vary with the character of the observer. We are the standard by which we must judge of external nature. The true understanding of natural laws is never attained wholly from without, nor immediately from nature, but rather from our own conceptions and deductions. Our senses, of themselves, teach us nothing, but only furnish us with impressions from which to infer and by which to determine the actual state of

things outside of ourselves. And these impressions must inevitably differ in each individual, in accordance with his own preconceived ideas of the nature or uses of the object he examines. The ancient Romans assembled as varied specimens of the animal kingdom in the great *vivaria* of the Flavian amphitheatre, as the Jardin des Plantes can number within its enclosures. And yet they derived from them, if any, but the rudest notions of their peculiarities, races, and modes of life; while the broader generalizations of natural history and comparative anatomy never once crossed their minds. Archimedes saw only in the convex lens an instrument to burn the enemy's fleet; but Torricelli, the revelation of a new world of microscopic nature.

Nor can numbers, any more than our senses, teach us anything by themselves. The mere observation of simultaneous or consecutive occurrences, however great the number of cases may be, can lead to no definite results which may not be fallacious. A causal connection must be otherwise established. By a neglect of this circumstance, observers have been betrayed into the most absurd conclusions. Some would regulate the periods of parturition by the changes of the moon, and make the births of our race coincide with the quarters of that satellite. Others, as Boudin, by computations, bring the motion of the earth about its axis and around the sun, into a certain relation with the weight and excretory processes of the human body, thus pretending to establish a tidal flow of our excretions, ruled over by remote planets; a supposition which might suggest to the astronomer that the next discovered member of the solar system be named Cloacina. It could be no more ridiculous for the stranger who passed the night in the steerage of an emigrant ship to ascribe the typhus, which he there contracted,

to the vermin with which the bodies of the sick might be infested.

An adequate cause, one reasonable of itself, must correct the coincidences of simple experience; and the mere numeration of any series of events cannot establish any general principles without analysis, classification, comparison and induction.

The term "statistics" is nearly equivalent to "political," or "social science"; and we prefer the use of the expression, "the numerical method," in medical *parlance*. This method has both a value and a fallacy. And our subject has been well stated in this respect, and wisely restricted to the *observation*, or natural history of disease. For it so happens that this is not only one of the most important branches of medical science, but one of the most difficult to define and accurately determine.

By the natural history of disease we mean the succession of phases which it exhibits when left to itself, uncomplicated by other morbid processes, and unmolested by active treatment. The wiser view of disease has gradually gained ground, that it is not a distinct entity, something extraneous to the usual processes of life, and inimical because foreign. But that disease is only a variation from health, a difference in the action of the normal functions of the body, yet only a modification of them. Hence the natural history of disease aims to exhibit all the morbid changes in the vital phenomena, whose sum constitutes sickness, or variation from health. We are led to believe, too, that diseases, in their course, have a natural rise, increase, intermittence, climax, decline and limit. The establishment of these facts; the self-limited nature of some diseases; the inherent tendency to recover in others, and the proportional mortality of dis-

eases generally, when left to themselves, are of the first importance in determining the value of therapeutics.

Such knowledge is, from the nature of things, very difficult to acquire. The accumulated errors of the past, and the ever-present obstacles of interest, prejudice and partiality constantly impede our progress. It is by no means easy to find a proper field for such inquiry; and a true estimate of the powers of nature is interfered with through the officiousness of art. Most diseases are subjected to so active treatment as must at once vitiate the result. The practitioner's own conscientious scruples against leaving any cases to the care of nature alone, from the fear, magnified by his previous teaching, that he might be injuring his patients; the non-perception of the utility of the knowledge to be so acquired, and the dread of being exposed to the charge of malpractice, all operate against his obtaining a knowledge of the natural history of disease. Effects are ascribed to drugs which really flow from natural causes, and are but the usual succession of the morbid phenomena; sequences are taken for consequences, and all just conclusions confused.

From the want of this knowledge; from defective observation, rash generalizations, and hasty conclusions *a priori*, have arisen the thousand conflicting theories which have degraded medicine from its true position as a science, and interfered with its advancement as a practical art. Soon after the decease of the great prototype of medical observers, Hippocrates, such sects as Dogmatics, Empirics, Methodists, Pneumatists and Eclectics, violated the principles which he laid down, and successively assumed the control of disease. Two of these, the Empirics and Eclectics, have survived the rest. Later, the Humorists and Solidists divided the medical world. Pharmacy next mounted the throne, and conducted

a reign of indiscriminate drugging, in which the value of a prescription seemed measured by its length. Treatment oscillated between such extremes as the antimonial tolerance of Rasori and the bleeding *coup sur coup* of Bouillaud. Etiology, in the hands of the most opposite characters, was content to trace all maladies to a single cause; which *materies morbi* Broussais located in the alimentary canal, but Hahnemann upon the skin. Sydenham, Boerhaave and Hunter countenanced a return to the neglected rules of Hippocrates; and a tendency to more exactitude in observation, owing its inception mainly to the physical diagnoses of Laennec, culminated in the numerical method of Louis.

The unfortunate student of medicine has therefore ever been placed between the horns of this dilemma; either to try to reconcile these conflicting theories, or to mount the favorite hobby of the most enterprising spirit of his times. Not only has he had to pursue subjects of study, in themselves dry from their apparent want of connection, but he has, more than all else, been crushed by the multitude of isolated facts, simultaneously presented to his mind and memory, for mastery and retention.

How tempting, then, must the supposed certainty, the easy generalization and the all-embracing tabulations of the numerical method, have seemed to him! A way appears at last to have been opened out of his difficulties, and he, perhaps too eagerly, follows the most promising path.

Although Louis first applied the numerical method, in its strict sense, to the observation of disease, yet the numbering of cases is as old as Hippocrates, and it was used by every practitioner who *counted* the facts of his experience since that time. Captain John Graunt, of London, has the honor of being the first writer who ever directed the atten-

tion of the world to the comparative births and deaths of different cities, years, seasons and sexes, and to the comparative mortality of disease. This he did in a work published in London in 1662. He had much genius for observation, and was really the creator of the new science of statistics. But the name owes its origin to Achenwal, of Göttingen, who published a work in 1749, in which the term *scientia statistica* occurs for the first time. The use of numbers as a means of comparison, in this work, led to the strange mistake of regarding their employment as a new method. It is more particularly during the present century that an attempt has been made by numbers to give to many subjects the exactness of the physical sciences, and to compensate for the want of demonstration by averages, and the balance of probabilities. Statistics, says Mr. Buckle, although a recent science, have already done more to advance the cause of human knowledge than all other methods of investigation put together. Quetelet stands, perhaps, at the head of modern statisticians. The wideness and variety of the application of statistics is only equalled by the varying degree of certainty which attaches to their results. Births and deaths, marriages and morals, accidents and crimes, are all averaged and tabulated, year by year. Diseases and causes of death; epidemics, hygienic and local surroundings; trades, professions and crops, are equally subjected to numerical analysis. And from this the curious fact of the average uniformity of all events results. Thus, male births are ever in excess of female in the proportion of about 21 to 20; marriages depend on crops and prosperity; disease favors certain districts in proportion to their hygienic state; fecundity succeeds epidemics; accidents do not exist, but the same yearly average of casual-

ties and crimes prevails approximately at all times. So that one can always predict, with much approach to certainty, how many persons will steal, or murder, or commit suicide, and even by what modes, or weapons, in any given period of time. Some have even carried this so far as to assert that the same number of misdirected letters, in the average, pass through the London post-office every year; thus proving that not even occasional absence of mind is purely the result of chance.

It is obvious that very different degrees of certainty must prevail in the various kinds of statistics. Thus, commercial averages of imports or exports; financial statistics; or those of births and deaths, or of the crops — must be approximately more accurate, than those which relate to hygiene, to epidemics, or to casualties. And this, because the data in the former cases are few, simple and ascertainable; but in the latter, many, complicated and obscure. And here we shall find one of the cardinal distinctions to be drawn between ordinary statistics and the numerical method as applied to disease, as well as one of the many fallacies of the latter.

We fear that the mistake exists in the minds of some, of confounding together the laws and results of physical signs with those of the numerical method. It is true that the application of both began, so to speak, in the same country, and that they are nearly coeval; we are the more apt, therefore, to confound them, though the distinction between them is really wide, and should be always borne in mind.

Both these methods claim great accuracy; both also are apt to be carried too far. The one to the neglect of general, rational symptoms; the other to the tabulation of

incomparable facts, and the drawing of illogical conclusions from too few, or too obscure, *data*.

Man is incapable of observing all the phenomena of any event, but this is necessary to a perfect view of it. It is precisely the younger observers, the advocates of exact investigation, who think they see everything, and that they are the first to observe correctly.

Yet there is much practical wisdom acquired in life, on which men are obliged to depend, and which was never obtained by a formal or mechanical process. Thus, a knowledge of human nature is not learned by counting, but by reasoning; by induction, and not by numeration. And statistics, like physical signs, when pushed to excess, may destroy that readiness and practical tact which is of the most value in the treatment of urgent cases. Should one wait to tabulate and compare the symptoms with the mass of statistics previously acquired, the individual case would probably die, while waiting for relief. And it very unfortunately happens that the most sudden diseases have not the best established therapeutical laws. In surgery, no one would hesitate to compress a bleeding vessel; but in medicine, room is always left for a balance of probabilities; and the statistician would have to enforce a fatal delay before he could decide from numbers to bleed in apoplexy, or to vomit in croup.

While therefore mere observation and numbers, by themselves, are equally inadequate to unfold to us that most important of subjects, the natural history of disease, some further method must be sought for than pure and naked experience. For all that we know by experience, or that which we express by an empirical law, is only a simple fact that certain effects and influences occur together, without

our being able to point out their mutual dependence. And as there are no such things as accidents, or exceptions to natural laws, so in the living body, as elsewhere, no effects can occur otherwise than as consequences of fixed causes. They seem accidental and exceptional only because they are unexpected, and their antecedents unknown. Therefore, although the causal connection of events and phenomena is in our science peculiarly hard to trace, it is still the most legitimate object of investigation.

Analysis, followed by synthesis, are the two auxiliary methods in our search for causal connections. Analysis must precede synthesis. We must follow up the stream of events to their tributaries and source. We must break up and search the groups of similar and related individual facts, and then apply their laws to aggregates. By a natural impulse we follow analysis by an attempt at generalization. And here experience, fallacious though it be, must confirm our conclusions, or they are valueless. It is equally necessary to correct generalization, that we should discover resemblances, and demonstrate an agreement in essential points, among the phenomena, or relationships which we are seeking to bring under the control of a single law. Thus we should fail to explain the different agencies of chlorine on colors and on odors, did we not know its affinity for hydrogen, which operates in either case.

Yet, without generalization, our experience is but a chaos of empirical facts. And it is in the science of medicine that this difficulty of separating single phenomena from the magic circle of the whole, or of judging of their complexities in aggregates, or of generalizing widely and wisely by real resemblances, essential agreements, and well-known effective causes, is the greatest obstacle to real advancement.

We venture to say that there is but one other science, that of meteorology, comparable to medicine in uncertainty, and in the number and variability of unknown influences which control its results. Who is a true prophet of the weather, or of disease?

For example, what a variety of influences affect a single organ, the eye. The laws of vitality, the rules of optics, the unknown chemical changes which photograph on the retina the image of the object seen; and, finally, the equally unknown connection of sense and nerve, brain and perception, all coincide in the government, the regulation and the result of vision. All its lenses, curtains and tunics are endowed with life; all are nourished by constant changes, and all are connected with the machinery of the whole organism. The cornea transmits, the iris cuts off the rays; the humors refract, the lens focalizes and renders achromatic, and the retina receives the soft impression of the sun's beams. Secretions moisten its exposed surfaces, and soft ciliæ free it from dust. Muscular agencies move it in combined action; habit, mental influence, or some unknown law, regulate the harmony of the perceptions of both eyes, and replace the inverted image which the upright object makes, into its proper position in the sense itself.

"The structure of the human frame as much surpasses the most skilful work of man's hands as its functions do the play of his most ingenious mechanism and its products the results of his most refined chemistry. That which he knows bears no proportion to that of which he is entirely ignorant, and what he sees, he sees but darkly. He seeks for causes, but they elude his search; the vital principle, which contains the solution of his difficulties, baffles him at every turn; he strives, as it were, to seize it by force, but the

violence which he uses defeats itself, and the tortured body dies that it may preserve the secret of its life. Such, and so inscrutable is the body in health; disease surrounds it with new mysteries. Its structure passes through strange transformations; its functions undergo wonderful changes; a new chemistry presides over its secretions, and new principles seem to pervade its every part. Exposed from without to a thousand varying influences; subject within to innumerable changes; governed by a subtle principle which pervades every part, but seems to have no single centre of action; the tenement and instrument of a mind which it both obeys and governs — the human body forms, beyond all comparison, the most difficult, the most complicated study which offers itself to our choice. Our knowledge of such a structure must ever be imperfect, even if we confine our inquiries to a single human being, or if every human being were the counterpart of every other, and external influences produced the same effects on all. But each human body differs from every other in outward form, in inward structure; in health, in disease; in the degree of influence of external things upon it; in the effects of food and remedies."

What wonder, then, that the careful medical logician should lay down as general laws: First, that, "In the living body, the same event or effect may occur in very different manners, under varying and dissimilar circumstances"; a fact which greatly complicates the investigation of causal connections. And, second (because of the very varied influences in the development of vital phenomena), that, "In the living body no occurrence or effect ever takes place with perfect constancy and certainty, and always in the same manner; and that we cannot, for this reason, with perfect certainty, predict or expect any occurrence or effect whatever."

From these insuperable obstacles medical science has conducted its inquiries through two distinct stages, and is only partially within the borders of the third. These stages, according to M. Compte ("Philosophie Positive"), are, first, fiction and faith; second, speculation; and third, positive science. Anatomy, physiology, surgery and morbid anatomy are either firmly established in, or have already entered upon the third stage. But the natural history of disease has long lingered in the first two eras, and is slowly emerging from them; while therapeutics, worst of all, remains, but for a more or less fallacious empiricism, as firmly rooted in fiction, faith and speculation as ever.

Medical science has always been in advance of medical art; and the progress of the latter does not correspond to the discoveries of the former. The power of healing is much inferior to the capacity of knowing; the treatment, to the diagnosis of disease. All the obstacles which arise to impede our progress in the inquiry into the causes, or the natural history of disease, assume a tenfold greater magnitude when we attempt to investigate their treatment. So, likewise, the objections to, and fallacies of, the numerical method vary with the subjects for which it is consulted. Statistics of etiology and structural lesion are more reliable than those of pathology; and all of these, *a fortiori*, than those of therapeutics.

The question naturally arises whether the difficulty in medical investigations is inherent in the subject itself, or is due to faulty observations. Both causes probably concur in producing it. If the complexity and uncertainty of vital phenomena prevent a clear and comprehensive view of their relationships and laws, no less do the preconceived opinions and inaccurate modes of study of the observer stand in

the way of the attainment of the truth. The former of of these applies with more force to the medical science than to the medical art; to a collection of principles than to their practical application.

Originally a mere art, medicine took the form of a science when men began to collect, arrange and analyze individual instances, and to express what was common to them all in the form of propositions. The art which preceded the science differed greatly from the art which sprang from the science. The one was mere empiricism; the other, practical science. The art of medicine, as it now exists, is the offspring of science; and we can no longer regard individual facts in any other light than as suggestions to new inquiries, hints for practice, and solitary materials for the formation of theories. So, true observation is the union of thought and perception, which analyzes, arranges and classifies the facts collected. A simple employment of the senses is not observation; nor does the exercise of them constitute experience. In this sense, therefore, the science of medicine cannot be said to be wholly empirical.

It is impossible that we should arrive at a certain medical comprehension and science by mere observation, and the collection of so-called experiences and facts, of themselves; for this is only the first step. The savage, wandering in the forest, sleeping without shelter, and dependent on the wind or weather for power of locomotion and the means to reach his prey, has no doubt always been a keen and constant observer of the heavenly bodies and the clouds during all the nights of his existence. But his experience, unaided by comparison and generalization, has never taught him the true magnitude, or motion, or relations of the stars, nor the simplest laws of meteorology, as laws, and not as successive

and empirical facts. Nor would the physician ever obtain, by mere observation, whether by palpation, auscultation and percussion, or by autopsies and microscopical and chemical examinations, however minute, a true insight into the real condition of his patients.

These are all means of knowledge, but, unless aggregated and compared, they must remain only isolated, empirical facts. We cannot wholly separate theory from observation, even by substituting figures for words. We must be careful only that our theories are based on constant and recurring facts. Even the purest empirical writer on medical science, styles that science, "*the phenomena of life, with their relationships classified and arranged.*" And although anxious to have it understood that science is not the inductive or reasoning process added to facts, nor a theory built upon facts, yet he equally includes the classification and arrangement of phenomena, under his definition.

Such classification, dependent on the identity or similarity of certain groups of phenomena, and their dissimilarity to others, necessarily requires comparison and generalization. And although some exercise of invention or intuition may lead to useful discoveries, afterwards confirmed by experience, yet *a priori* conclusions are but too apt to be premature. Induction; reasoning *a posteriori*, which forms the distinctive feature of the Baconian philosophy, is the safer course in all sciences. Theorists have uniformly neglected it; but careful observers have attained their most important results by following its laws. By it, or by observation and *experiment,* that *vexatio naturæ*, as Bacon calls it, the physical sciences have alone advanced. So all other branches of knowledge, which are, from their nature, incapable of demonstration, must proceed by comparing observations, and analyzing

experience, rather than by either *a priori* theories, or simple empiricism, to establish general principles, and natural laws. But what is called a law in natural science, differs somewhat from the popular use of this expression. A law of nature is nothing else than a general expression of the conditions under which certain phenomena occur, so far as these conditions are known to us.

We cannot account for a phenomenon by referring it to a general law. The law, or generalization, is governed by the phenomena, and not the phenomena by the law. So, for the sake of illustration, the laws of grammar are the expression of the conditions under which certain words and expressions usually occur. And when we say that an expression is at variance with the laws of grammar, we mean only that it differs from the more general usage which constitutes those laws. Good usage does not depend upon grammar, but grammar upon good (general) usage. A law of nature, also, has no coercive power whatever: whenever we speak of phenomena as *governed* by law, we imply some higher *will.*

The common fallacy that the "exception proves the rule," while it may show our generalization to have been imperfect really means only that the exception indicates by its rarity the existence of some more general mode of action, to which the majority of phenomena can be referred.

They, therefore, who seek to establish positive laws of disease by the accumulation of isolated facts of experience, succeed, it is true, in proportion to the breadth of their researches, but cannot, as long as their observations are finite, arrive at absolute laws. Particularly in the complex and vague field of medical experience, it is still more difficult to establish and verify general principles, or laws.

Another source of fallacy lies in the common acceptation of the word *cause*. Usually held to mean the power which originates any action, it logically includes also the conditions of its operation. Thus, heat, generating steam, is the power which moves the locomotive; and its machinery, the condition of its progress. Both would be called the cause of motion; though, properly speaking, one is a dynamical, the other a material, cause. So, in the human body, vital force may be the power, and respiration the condition of life; or miasmata might be the cause, and intermittent fever the condition of disease. Too much care cannot be taken in investigating that most important branch of science, the causal connection of empirical facts, to bear in mind this difference in the signification of the term *cause*.

It is obvious that the causal connection of isolated events in medicine is not to be reached by any single, simple process of experience or numbers. For the course of reasoning by the inductive process is, first, observation; second, comparison and generalization; and, third, the establishment of causal connection: and when we know *all* the conditions and modifying processes, we can establish a natural law. Therefore the observer needs, a mind to guide observation; observation to acquire facts; logic to estimate the value of observation; analysis to separate complex facts; analogy to compare them; statistics to average individual facts; the calculation of probabilities to define, as accurately as possible, the value of his results; and many aggregates, and almost infinite observations, to generalize laws.

Why medicine should fail in meeting our requirements, we can best consider by comparing it with the more exact sciences.[1]

[1] *Vide* "British and Foreign Medical Review."

The most perfect kind of human knowledge is that embraced by the pure mathematics. What are called the primary existences, as space, time and number, we cannot conceive *not* to be. Not only are they necessary existences, but all men who think about them must get very nearly the same notions concerning them. The measure of space, time, quantity and magnitude is number; number has the same meaning for all mankind, and it is the only thing about which difference of opinion is impossible. Numbers being independent of the things counted, and free from the errors of language, we can reason upon them, as we can upon nothing else. Arithmetic, algebra and geometry, and the whole of the pure mathematics, being sciences of quantity, and hence of numbers, and being freed by their symbolic expression from the errors of language and the errors of sense, are, as far as they go, perfect sciences. Arithmetic and algebra prepare, by their numbers, instruments of calculation for the use of the other sciences. The simplest use of these instruments of calculation is in the science of astronomy; which is eminently a science of numerical relations, as well as of pure observation. Calculation is the secret of the success of this science, and also of statics, dynamics and optics. These are all sciences treating of those simple relations and properties of matter which admit of being represented by lines, figures or symbols. The observations on which these sciences are based are of the simplest kind; and they offer the example of sciences of observation not much inferior to the pure mathematics in accuracy. Yet fallacies exist even in these sciences. In astronomical observations the senses are fallible, and the nicest instruments admit of error. But the astronomer rectifies his errors by multiplying his observations; he has recourse to the numerical

method, and takes the *mean* of as many observations as he can procure.

Chemistry is a science which makes extensive use of calculation, but is still more dependent on the exercise of the senses, since the properties of matter which it investigates are more complex and obscure than those of the heavenly bodies. The chemist, however, has the powerful aid of experiment; for he can create and re-create almost at will. He can make the objects of his investigation identical; he need determine them but once; he can use them also to determine others. But figures pervade the whole science, and all its statements are made in the numerical form.

A numerical theory — the law of definite proportions — converted the art of chemistry into a science: a position which it might not have reached by the mere questioning of nature — by experiment alone. The chemist, like the astronomer, has to multiply his observations and experiments to avoid error. Calculation and his power of making the matter he employs identical with that which he has already ascertained give perfection to his science. He is capable of synthesis, as well as analysis. But when he reaches the *organic* world, synthesis fails. And here we have the first sign of the uncertainty, the first shadow of the difficulty, which awaits the observer at the threshold of *Life.*

The mechanical properties of matter are investigated with as much zeal as its atomic affinities. A knowledge of them can be obtained only by repeated experiment, because they resemble each other, but are not identical. The mechanic, therefore, has recourse also to the numerical method: to ascertain the strength, or the durability of wood, iron or stone, he must take the mean of many trials.

Astronomy and chemistry, the one a science of observa-

tion, the other of experiment, owe their perfection mainly to calculation. The former is the more perfect, since it deals with simpler relations of matter, and depends less upon the exercise of the senses than the latter. But the latter owes its superiority over mechanics to the power which it possesses of making the objects and results of its experiments identical with those which it has already ascertained, and which bear the same name.

The certainty of a science seems, therefore, mainly to depend upon the extent to which it admits of the application of numbers and calculation, or of the numerical method, to rectify its errors.

It is not surprising, then, that much should have been hoped from its employment in the notoriously uncertain science of medicine, but only that it should not have been earlier applied.

The imperfections of medicine as a science are inherent in the subject itself.

"The physician, unlike the mathematician, is not the creator of his own science; unlike the astronomer, he has no simple relations of matter to deal with; he cannot, like the chemist, make any two things which he examines or uses identical; the objects of his study are more variable than the winds and tides; and the materials with which he works infinitely more difficult to adapt to their uses than the matter which the mechanic or engineer presses into his service. In all his preliminary studies (with the exception of inorganic chemistry), in all his original inquiries, in all his practical applications, he encounters the varying effects and complicated phenomena of Life."

True observation, or the union of reason and perception, the diligent use of the senses, not ignorantly or empirically, but knowingly and with a plan, can alone afford us any hope of penetrating to the arcana of the living functions in health and disease.

Medicine is a science rather of observation than experi-

ment, for the latter method is impossible in the natural history of disease, and of very limited and doubtful application in the therapeutical art. We cannot isolate individual influences from the magic circle of the functions of the body; nor thus place them in a distinct and favorable light for single, or repeated experiments. Were this possible, we should still be under the influence of one-sided and special views, and be in danger of seeking for that only which we wished. It is doubtful, moreover, whether we should be much the wiser, even if we could produce artificial diseases, or experiment with drugs; for the causes would be so complicated and numerous that we could not judge of the effect of each.

As observation is, then, from necessity, our chief method of acquiring medical knowledge, we might expect numbers, which express only aggregated, classified or generalized observations, to be of much aid to us in our pursuit.

After these necessary preliminaries, which have taken up so much space, have been duly considered, we have found, by their statements, that the senses alone, and numbers by themselves, can do nothing; that the natural history of disease, though the most important part of medical knowledge, is the hardest to obtain, while the want of it has given rise to conflicting theories; and that the student of medicine is oppressed by the multitude of isolated facts. We have glanced at the origin and history of the numerical method, and at its wide employment now in various sciences; and have shown that experience alone will not serve us, but that we must look for the causal connection of events; and while they are to be sought by analysis and synthesis, yet since generalization is peculiarly difficult in medicine, we finally must agree with the logician, that no effect or

event can be predicted with certainty in our science or art. We have shown why the science of medicine is superior to the art; that the numerical method is even more inaccurate in the latter than in the former; also, that medicine, not being entirely empirical, we must classify and arrange our observations. We have endeavored to explain why induction is the only true way to arrive at laws; and to prove, by the true definition of the term law, why finite observation cannot establish absolute ones. And having shown that various mental processes, as logic, analogy, comparison, etc., were needed in true observation, we have lastly compared medicine with the exact sciences, and inferred, from its great advantage in them, that the numerical method should be tried in the science of medicine.

We are now ready, therefore, to judge of the value and the fallacy of statistics in the observation of disease. It will be more convenient to reserve their value for our final consideration, and we will first treat of the *fallacies* of the numerical method, as applied to the observation of disease.

Such fallacies may, in the nature of things, exist either in the object, or the observer; may depend on some inherent defect in the thing observed, or upon defective observation on the part of the person observing. And first, with regard to the fallacies in the object.

The value of our observations depends on both their quality and their number. The most positive results in any science are attained just in proportion as the facts compared, which form the basis of the statistics, are identical. Identity of facts, submitted to the numerical method, cannot be found in medicine. No series of phenomena constituting disease, whether occurring in different patients, or in the same patient at different times, can be identical. Even the most

exact of symptoms, those included under the head of Physical Signs, cannot be expressed by symbols, or figures; nor are their relations so simple, nor their analysis so exhaustive and complete, as to warrant their being always considered *the same.* Although the numerical method is not a mere substitute of figures for words, yet its results will always be accurate in proportion to its approximation to figures, which are ever one and the same. No diagnosis can be so minute, no malady so defined, no human body such a machine, as to give identical results. Therefore, not only the demonstration of pure mathematics, but the identical certainty of experimental chemistry, must be foregone in medical science. But if no identical units of observation can be obtained, our next care must be to obtain those which are strictly *comparable;* for without this condition is fulfilled, our conclusions will be not only inexact, but of no value whatever. There is, first of all, great room for error in the selection of our cases, and in the circumstances under our control. The disease must be well defined and carefully diagnosed; and in this respect, acute are much preferable to chronic maladies, for the latter are, at best, of very difficult classification. It is obvious that cases of a different nature may be confounded together, and improperly compared in statistics. The symptoms are of little value without a just notion of the cause of the disease, and the real nosological whole which the entire group of symptoms represents. Thus, a bellows murmur in the heart may depend on a peculiar constitutional disease, as rheumatism; on ossification of the valves, from age; on disease of the lungs, reacting on the circulating organ, or on some peculiar state of the blood itself. Therefore it would not do to compare, for the purpose of tabulating and averaging, every

case which presented a valvular murmur in the cardiac region, without a knowledge of other concomitant disease, or the nature of the cause.

The patients must also be placed under the same circumstances of attention, diet and treatment, if the observations are to be continued through the natural history of the disease. But there are many circumstances beyond the control of the physician.

It is not, however, absolutely necessary that those things beyond our control should be included in the laws of comparable cases, nor that the want of them should invalidate our conclusions. It is true that we shall not get strictly comparable facts without them. But since the variability is known and limited, we can remedy it, in a measure, by the application of the numerical method.

But this requires the application of very large numbers of observations. This is well exemplified by the state of life insurance companies in America. Known causes of disease and laws of vitality are carefully collected and compared, but a vast number of unknown ones yet remain beyond control. To remedy these errors, the number of facts must be enormous, and extend over a long period of time. A sufficient number of years have not yet elapsed, since our country became populous, to furnish facts enough. And the result is, that the mortuary statistics of American life insurance companies are far inferior in reliability and exactness to those of the older countries; and hence, as a secondary consequence, the profits and success of such companies are far more precarious here than there.

So much is this the case in medical statistics, that the more modern advocates of the numerical method charge even Louis with having based his conclusions on too few

facts. The application of very large numbers to the calculation of probabilities we shall consider further on.

The larger the number of cases, the nearer we approach to demonstration. And to secure the greatest comparability, with the fewest sources of external error, and the best chance to correct them by multiplication, we must employ "the simplest cases of a similar kind in the smallest possible field; and the same kind of effects under the greatest variety of circumstances; and, finally, collect and compare the results."

Besides even the impossibility of procuring identical facts, or the chance of strictly comparable cases, we shall find another source of error, even in those cases which are comparable, in the individuality of each case. Patients are not bundles of symptoms, nor are diseases always bounded by the same formal laws. And it has been well said that we cannot weigh a cough, measure the exact extent of a pain, nor determine fever by the atomic theory. Idiosyncrasy, or the peculiarities of the individual, are as anomalous and impossible to reduce to rule and measure as the passage of the clouds. Nor are they infrequent. While similarity is frequent, there is usually enough unlikeness for comparison. Two cases of disease are as rarely identical in all their features as are the faces of the patients. No depth of observation, no accuracy of numbers, no vastness of tables, and no grasp of memory, will ever enable the practical physician to reduce the case before him to real rule and measure, or to dispense with the necessity of considering each patient by and for himself.

The numerical method affords us a numerical estimate of probability in a given number of cases; but this is not of much help to the practitioner at the bedside, who has to

determine the probabilities of the individual case before him, which may or *may not* be more or less similar to the cases estimated numerically. Perception, comparison and deduction are necessary for each individual, as well as in formulæ and tables. We may often learn from statistics, indeed, that of many effects or consequences, as the duration, course or result of a disease, one will occur more frequently under given circumstances than another. All this, however, admits of no direct application to an individual case. So many special circumstances and influences come into play in each case, and complicate the question and calculation to such an extent, that the conclusion cannot be a safe one. Each individual case has its own special result, which could not be calculated exactly from statistics. If we know, for instance, that of those attacked by cholera fifty per cent. die, and an equal number recover, we cannot, on that account, assume for an individual cholera patient, that the probability of his dying is precisely as great as that of his recovery. Such probability must be greater or less than the average, according to his age, habits, personal vigor, or the severity of the attack. Nor, again, if we knew that the mortality of smallpox was just one in four, could we predict for any given case of this disease that his chance was just one in four. It would be either above, or below that number.

There is still another important source of error existing in each individual case; allied to, but in some senses distinct from, idiosyncrasy. This is the "constitution" of the patient, as it is called; by which is meant the sum of all the influences of locality, station, hygiene, occupation, habit, diet, or accident, which have acted upon the individual from the time of his birth, until the period of the

disease we are treating. And not only this, but influences called hereditary, in some diseases of great gravity, which extend back through generations before his birth. It is plain that we can never expect to attain a knowledge of all these influences by the most detailed examination or the largest tabulations; yet such knowledge is indispensable to render our facts, or units of calculation, not identical, but *strictly* comparable. It is, after all, with much justice, that, following the popular idea, we hear patients say, "I value my family physician because he understands my constitution"; and so, to the extent permitted by his finite faculties, he does.

The positiveness of principles (and principles are only generalizations), says an empirical writer, applies only to the principles themselves, and not to the individual phenomena and relationships, by the aggregate of which they are composed. This applies to both pathology and therapeutics. The positiveness of the law cannot apply to single instances. So diagnosis, prognosis and treatment must ever depend mainly on an accurate knowledge of the individual cases themselves.

To avoid as many as possible of these errors, to compare justly the essential points of one of those great nosological groups of symptoms which constitute a single disease, how many observations, and how many separate comparisons must be necessary. Each symptom, essential or accidental; each sensation, positive or negative, present or wanting; every organ, as the skin, the tongue, the heart and lungs, as well as the more general functions indicated by the pulse, respiration and excretions, and, finally, *all* the functions, whether morbidly affected or not, must have tables, subtables, columns and balances by themselves. So, too, must

the previous history of the patient be detailed with a fidelity which would require a mind and memory far beyond the average of humanity, especially when sick; and the inquiry into so many minute symptoms demands a patience, an accuracy, and a power of differential diagnosis, such as very few of the best trained physicians possess. It would be impossible to find cases strictly comparable in all these respects. The presence of any one symptom cannot be offset by the absence of another; nor even in strictly identical symptoms can those either wanting, or in excess, be mutually balanced, unless by numbers extending over vast series of cases, and a very considerable length of time. It is plain that the busy practitioner can never find time to work out such numerical results for himself, but must depend upon the labor of others.

Not only does this independence apply to different classes of maladies, and to individual cases, but we shall find, by pushing our inquiries more into generalities, that no department of medical science follows from any other, but that each is distinct by itself. A knowledge of one branch of medicine cannot be deduced from any other, but each also must be studied by itself. Thus, our knowledge of anatomy is distinctly the result of pure observation. Physiology is not deducible from anatomy, any farther than we can trace a general adaptation of means to ends; as that the skull is made to contain, or the heart to circulate, something, but what, its uses or functions, we know not.

Neither is pathology deducible from physiology, though the common opinion is just the reverse. We cannot infer the action of a function in disease, from its normal action in health; as, for instance, the excretion of urea by the

kidneys in health, but its retention, and the excretion of albumen, a constituent of the blood, in Bright's disease. Physiology is useful to pathology only as a standard of comparison; and *so* it is very necessary, in judging of the comparability of many units and data of statistics. Etiology, too, does not follow from pathology, but is the result of observation alone. And, finally, therapeutics are not founded so much on pathology, as on simple experience. All this must greatly increase the labor of the numerical method.

And since pathology is not founded on physiology, it follows that the action of medicines in disease cannot be safely inferred from their action in health. Therapeutics establish the relations between articles of the materia medica and certain morbid processes, not healthy ones. To a limited degree we have exceptions, as where an emetic substance would empty the stomach of a well, as quickly as of a sick, person. But opium would often have far different effects in health or disease: pain alone being a perfect antidote to its poisonous action; and other instances might be cited. This does not interfere with the accuracy and value of the researches of Lehmann and Bidder and Schmidt, on the physiological action of water, coffee, alcohol, or mercury; but should be a caution to us not to infer too readily that the same results will follow their employment in disease, as in health. We wish only to show that the numerical method, when carried into pathology and therapeutics, meets only with increasing uncertainty and labor, and can in no wise be aided by a knowledge of the more rudimentary branches of medical science, which may have been earlier acquired. Everything tends to prove that not only each person and each branch of medicine as a science

or an art, has an individuality which cannot be readily compared to others; but that diseases, especially, admit of infinite variety in the degree, the number and the order of their symptoms.

Yet for the correct study of disease, an arrangement of symptoms into groups is important, on the one hand, and a searching into the intimate nature and causes of such groups, on the other. Otherwise we are in danger of erecting symptoms of many diseases into diseases themselves, while in fact they are only symptoms. And in popular speech we often commit this error, calling the most prominent symptom, as diarrhœa or hæmorrhage, the disease. After we have successfully accomplished these nosological generalizations, we shall still find nature too complex for single observation, or numerical analysis. For our symptoms must be studied one by one, in the order of their development, and the precise period of appearance of each must be learned. One is apt to be confused by the multitude of symptoms which a patient presents. It is here that we discover the true value of hypothesis; not to analyze or theorize, but to enable us to isolate certain symptoms, previous to observation. Here, too, when it is practicable, experiment would come to our aid, because by it we can place certain symptoms in the best position for examination, thus judging of individual influences; and, in the physical sciences, we can repeat the experiments as often as we need. Fallacious grouping and the complexity of nature offer, therefore, serious obstacles to the correct analyses of the numerical method; while experiment is seldom admissible.

So many forces are at work modifying each other in life that correct induction is difficult, and the establishment

of causal connection, at times, impossible. Vital phenomena move in curves, and not in straight lines; the non-appreciation of any one of the motive forces destroys the balance of antagonism, and would be fatal to the most careful calculations. Even the student of the physical sciences would find it difficult to ascertain the laws of motion solely from bodies kept in a state of rest by opposing forces.

Again, the natural sequence of morbid phenomena is another source of error in establishing by numbers the natural history of disease. Not knowing the whole chain of causal connection, we are unable to decide whether one event takes place in consequence of a stage of the disease arriving to determine it, or from some other cause, which we have under our control.

Thus, too, the very different influences under which patients may be placed, were they only so seemingly trivial as the temperature or the state of the atmosphere, have a modifying effect on each case, which we should seek in vain to reckon or account for. Time and place even may render the statistics of different epochs, or localities, wholly valueless for comparison with others. The season of the year, the tendency of the epidemic then prevalent, the very various effects of good or bad locality, in a hygienic point of view, may all concur to derange the true balance of calculation.

We are in danger also of forgetting that it is not alone the number, but the intensity also of the symptoms, which are to be the units of our statistics. But the latter cannot be accurately measured, nor expressed in numbers.

We have already adverted to the necessity of very large numbers in determining vital phenomena; the true use of

the calculus of probabilities, and the approximate accuracy of which it is capable, we prefer speaking of under the head of the value of statistics, towards the close of this article.

We come now, then, to the crowning fallacy, among the *objective* ones, of the numerical method, namely, the influence of the Vital Principle.

Medicine can never be an exact science, since it deals with the vital principle — a principle in itself changeable, self-supporting, and self-regulating. Vital force is the great perturbative element which renders the results attained by the faithful student of nature approximate rather than precise. The calm test of experiment and the pure logic of analysis in organic chemistry are rendered uncertain, through an imperfect knowledge of its laws. Chemical processes, which, duly carried out under similar circumstances, give always the same result in the laboratory, are often wholly and inexplicably changed in the living organism. It is very evident, then, how it must disturb the results of pathological statistics; nor does there seem to be much probability of its being finally fully understood.

Liebig, on the one hand, and a modern and very voluminous medical writer of this country, on the other, represent the two extreme views held regarding it. The former would reduce it to a physical, if partially unknown, phenomenon; the latter would exalt it into a position of complete supremacy over all merely physical laws. Both, probably, equally err. The second-named gentleman has been betrayed by his enthusiasm into a denial of all chemical theories as applied to the human frame; of all discoveries of the microscope, and asserts, even, that the lacteal absorbents have open mouths. Liebig endeavors to bring all vital

manifestations under a few universal laws of chemical affinity, and flushed by his discovery of the interchange of oxygen and carbon in the capillaries, and its connection with animal heat, hastens to construct a theory of calorifacient and plastic foods, and to draw close lines of comparison between vitality and some forms of electricity; conclusions, to say the least, premature. To his views Carpenter inclines; but Paget and Dalton are disposed to view the vital principle as a higher law. Carpenter describes vital force as a power correlative with the physical forces; as, for instance, that it may be the mode of action of heat or electricity in the body; and that physical and vital forces mutually give rise to each other. Paget says that vital force is distinguished from all others by its powers of generating typical organic forms, or *modality*. Though correlated with the physical forces, it has no identity with them.

The distinction is clear between the force, which by chemical action prepares the material for constructing an organ, and the force which forms the ideal plan of the organ, and constructs it of this material. Although the phenomena of living beings cannot be accurately analyzed, yet the two antagonistic forces are the organic typal, or modal force, creative and preservative of the organic form; and the chemical forces of the material molecules, that keep the substance of the forms in endless change. To take for illustration the phenomena of cell-growth. Mechanical force governs the position, shape and relations of the cell; chemical force governs its composition; but vital force assimilates it to the organ of which it is to form part, and gives it the power to partake actively of the vital processes.

It would seem, if further argument were needed, that the simple fact of the abrupt cessation of the chemist's power of

synthesis, at the verge of organic life, were enough to prove that vitality was distinct from physical laws.

Although it is true that science has gradually brought some phenomena of digestion, heat and nutrition under the dominion of chemical laws, yet the total failure to subject the nervous element, and its connection with mind, to any sufficient physical or material hypothesis, would also incline us to believe that there is indeed a higher law of life, inscrutable, omnipotent and omnipresent in the human organism, and that that power is vital force.

Such being the sum of our possible acquaintance with *vital force*, it is obvious that we have present in all our formulæ of vital phenomena, in health or disease, an *unknown element*, which no algebra or calculation can resolve, and which must at once vitiate the results of the numerical method.

But were all these fallacies of the object explained, or done away with, we should still have the liability to serious errors in the subject, or the observer himself. And first and most important of these is the influence of his own mind (the *ego*, as metaphysicians call it) upon the results of his observations.

The power of correct observation is innate; hence all observers are not equally good. The facts, then, of various observations will not be alike, nor alike reliable; but there can be no just comparison of dissimilar or doubtful facts. We never separate the object from the perception; it is impossible to do so. What we call objects are, then, our ideas of them; and our ideas will vary according to our preconceived notions, and our judgment. These observations are not comparable. Probably it is through our judgment that we err oftenest. We are too credulous of notions which

agree with our own, and too sceptical of the contrary. Everything that is novel irresistibly attracts some persons. In medical science we are ever ready, like children, to follow any authority.

When we express our own explanation of what we have observed, compared and grouped with many other things, we describe it as it appears to us. For this reason our whole previous knowledge and experience, our notions and views at the moment, acquire a much greater influence over the mass of our observations, at the bedside, than we are conscious of. We are continually liable, in confounding our own notions with our observations, to fall into the same error as metaphysicians, who have been unable to solve their own problems, because the mind observing was the mind observed; the mental faculties were both the instrument and the object of investigation. These philosophers were obliged to employ a fallible insight to detect fallacies in their own minds.

It is plain that our tables of cases are filled with the vagaries of as many minds as there are observers. We cannot guard against their mistakes. Everything that suits us assumes such a magnitude in our eyes that it causes us to overlook many other important details. A deficient experience and youth formerly inclined us more to theorize from our observations. Maturity is a safe age for the observer and collector of empirical facts. But, at any age, we are too apt to make rash generalizations. The very talents of an individual with any peculiar tendency to explore only certain subjects become injurious to the medical profession by establishing premature and special, or limited, theories.

Specialists are particularly prone to error. The advantage to medical knowledge of so many minute observers,

each investigating a single subject, is more than counterbalanced by their unconscious tendency to distort facts to suit their theories. And if it be said that there can be no difference of opinion about figures, we can easily point to a hundred instances in medical history where the unitary symptoms which are the basis of statistics have been misconceived, preconceived, or misstated, by honest, but prejudiced, observers. Even if we are not specialists, we, very few of us, escape many years in practice without contracting some bias, which would cloud the clearness and accuracy of our perceptions. No man is wholly free from it. And provided that we hold our wayward tendencies sufficiently under control to prevent our being led into any positive fallacies in observation, we are still in danger of not finding, or of overlooking, the most essential points in a case, and of dwelling upon those which are less characteristic and important. Thus two observers, taken from the number of general practitioners, may render a very different account of the same case. It may be objected that such errors as these are inseparable from any human investigation. But it must be recollected that we are trying by statistics to free our art from fallacy; and that the science of numbers stands or falls with the identity or comparability of the facts observed, or with the reverse.

Provided, however, that we escape all these sources of error, another awaits us in the use of language and definition. It is not true that the numerical method is a substitution of figures for words. Numbers alone can never supply the requisites of articulate speech. And, unfortunately, the language we employ is a very defective one. The terminology of medicine is very far from definite, because originally formed by ignorant men; yet we cannot

avoid using it. The literal meaning of technical terms is no longer their correct one. False expressions, too, influence our ideas, in the end. Our idea of a disease is got from a set of symptoms described and grouped by words. Yet the latter, as well as our definitions, change with time.

It is as important, too, in establishing theories from facts, that our classifications should be identical or similar, as that our definitions should be accurate. Diseases must be classified on necessary and general conditions, not on variable and local ones. This is difficult, since the species of disease, its seat, lesion, or even each particular instance of it, all differ from the others. We are apt to be misled by false analogies. And even when we seek for what we deem the soundest basis, we shall find anatomical changes, as the foundation of our classification, of but little value to the practical physician, since attention is not directed to those points of pathology which are most important to him.

It will be unnecessary to prove that diagnosis must be, we may say, *the* most important element in the numerical method. Difference or error, here, is necessarily fatal. Yet, this is one of the most difficult parts of medicine. The power of minute and differential diagnosis varies much, not only with the knowledge, but also with the mental acumen of the observer. The observers of facts which are to form bases of calculation need peculiar care and caution. "A corps of trained observers is needed — trained in the same school — so that they may observe alike; then their observations, whether right or wrong, will be alike right and wrong." That is, they will be truly comparable, even if fallacious.

We shall find that observers have varied much at different medical eras. "Every one is, and remains, a child of his

time." It is impossible for the medical observer, any more than any other person, to escape the cotemporary influences of his age. We are insensibly affected by the views of those around us, in spite of ourselves. The theories prevailing; the erratic views of some innovating genius, who may have escaped somewhat from the above influences; the reactions constantly taking place in opinion in consequence of previous errors in doctrine — all must warp and influence the medical observer. The pupils of Broussais, Laennec, Bouillaud or Hahnemann will, and must, *see* different things in their patients, as well as pursue different treatment.

Besides this, if we take the same observer, we shall find that some circumstances always make a stronger impression on him than others. The rarer events will even lead him to overlook the more frequent; because the former will attract his notice by their infrequency. Yet the constant repetition of the latter renders them much the more important for practical purposes. Thus a positive always impresses us more than a negative fact; the occurrence of a certain symptom in five cases, more than its absence in twenty; a cure, more than a failure. Some unhoped-for success attending a remedy firmly associates it, in our minds, with a disease as a specific, while it is really only a coincidence. "Extraordinary and interesting cases are always remembered." Yet great caution should be used in admitting them to much consideration in our experience. It has been adduced as a striking proof of the fallacy of simple experience, and the value of the numerical method (or counted experience), that Louis himself found that every *a priori* conclusion which he had formed in his own mind from his experience — or the recollection of his own facts — when submitted to arithmetical analysis, proved to be erroneous. This proves,

indeed, the fallacy of memory, but it does not prove the truth of figures based on experience; for the errors may exist in the observation, as well as the recollection of facts, as we have already shown.

Not only a capacious intellect, but very great shrewdness is necessary for the correct observation of disease. Those facts which are to form the units of averages should be culled with peculiar care. Leading questions must be strictly avoided; and negative, collected with the same industry as positive, facts. For organs, even *structurally* modified, sometimes give rise to no symptoms; and this should impress us with the necessity of noticing all the functions in our examinations. It must be recollected, however, that while all these things are essential to a correct employment of the numerical method, few observers are equal to carrying them out. In particular, will positive impress more than negative facts. Very few would have the shrewdness ascribed to an ancient Grecian, who, on seeing the votive tablets suspended in the temple of Poseidon by those saved from shipwreck, asked also for the names of those who had been drowned in spite of their vows.

What is true of one place may not be true of another, with regard to disease; locality admits of but loose connection with morbid processes. It is difficult to compare different epidemics justly; it is much more difficult to estimate the comparative prevalence of chronic disease, if one searches for its etiology in the influence of place — in seeking for a comparative view of phthisis, for instance, as it extends, more or less actively, in many neighboring towns or counties.

We cannot justly conclude that the seaboard, or inland

townships are the more exempt from, or that high or low, dry or moist localities favor the ravages of tubercle, on so simple data as the mortuary statistics of the several places, in this respect. The number of deaths from consumption in a certain town, or even parts of a town, for a few years, does not prove much, positively, with regard to the influence of the locality on the disease. And this, because there are other more important causes, predisposing or exciting, of tubercle, which are ignored in the inquiry. Such are, hereditary taint; occupation; fluctuations in population, and too short an average of years. Many natives of the place may have derived their tubercles from parents, who were born and reared elsewhere, some years before; many, too, may owe their weakness to marriages of consanguinity, or to personal vices of constitution. So, too, the trade, and social status of the individual case must have a wide influence; for we should naturally expect more phthisis among a village of shoemakers, for example, than in a fishing town. Such hereditary, or other innate influences as there are, may vary much, on one side or the other, from year to year, from the emigration, or the moving of a certain percentage of floating population. And to compensate for these sources of error, a much longer series of years must be devoted to tabular returns — longer in proportion to the number and complexity of the causes involved.

Statistical results require to be controlled by new results before they can obtain the force of laws. The advocate of the numerical method is sometimes as one-sided as the specialist. He is ready to forget that figures are not brains, tables not perceptions, and that recorded observations do not give the power of observing. The statistician is but too often as fallacious and extravagant in his conclusions as

those who rely exclusively on physical signs; both equally overlook the rational part of medicine.

Striking examples are not wanting, and we do not have to go further to seek them than the pages of the contemporary periodicals of medicine.

One enthusiast recently proposed, in all gravity, to deliver all presentations by turning, as soon as the os was dilated. Another (T. J. Austin, on "Paralysie Générale," in the *Medical Times and Gazette*, November 12, 1859, p. 486) says of the condition of the pupil in the general paralysis of the insane, "The iris is always affected; generally unequally in the two eyes. When the *right* pupil is most affected, the general tone of the delusion is *melancholic;* but when the *left*, usually *elated"*; whence he derives, by a brief chain of reasoning, the startling deduction that "the right *thalamus opticus* is the ganglion of natural painful emotion, and the left, of healthy, pleasurable emotion." And this result is based on the observation and autopsies of *twenty-six cases!!* Surely the fallacy of a too small number of observations requires no more striking illustration.

Nor are the results in large averages always more satisfactory. For example: an article, in the *Archives Générales de Médecine*, June, 1859, p. 691, *et seq.*, based on some thousand observations, and the investigations of Dr. Adams in the *Massachusetts Medical Communications*, Vol. IX, No. IV, 1858, of some seven hundred cases, exactly *contradict* each other in certain conclusions drawn from the statistics of vaccination.

"Of all dangers, a fallacious certainty is the greatest. A simple process of verification *a posteriori*, like the numerical method, never can be elevated to the dignity of a system, since it will be eternally true in medicine, that the problem

is individual." We know that this method must be still more incompetent for the treatment of disease. And it requires, finally, such an amount of prolonged labor, that neither the lifetime nor toil of any one person is adequate to it, but its statistics can only be drawn from the records of great hospitals. Louis himself said of it, that nothing was more simple, and nothing more tedious.

Notwithstanding so many and so valid objections, the numerical method has not only been dignified with the name of a science, but actually exists, and can exhibit certain practical results not devoid of importance.

It would be very unfair to pass them by, and we will therefore speak, in conclusion, of the *Value* of Statistics in the Observation of Disease.

In a limited degree they have a value; far greater in some departments than in others. This value descends in accuracy by a progressive ratio, and in the following order: Mortality and Births; Hygiene; Etiology; Pathology; Therapeutics. The last is infinitely less certain than the first. And in accordance with our previous conclusions, we find the statistics reliable in proportion to the simplicity of the *data* from which they are calculated.

Even if genius could grasp the laws and causes of disease, observation would still be necessary to test their truth. We shall find in medical history that it is the detailers of facts alone who escape oblivion. We see no examples in the history of science of any individual genius throwing itself far in advance of its contemporaries; but all attainment is the result of slow and combined exertion. Faithful description, too, is always valuable, though the hypothesis which it seeks to establish may be absurd. And even if we settle nothing by our observations, the gradual accumulation of our facts

may enable posterity to do so. A great mass of medical knowledge is, even now, only waiting for analysis. The authority of experience is but the attempt of an individual to generalize. And since no memory could recall enough observations to generalize just conclusions, we have need of the numerical method, which counts and compares individual facts. Nothing is here arbitrary or capricious, but simply mechanical. The correctness of the results is settled by a mathematical test, over which we have no control. Some laws require many more facts to establish them than others. But it is only when the objects contemplated are few that individual varieties seem infinite: large masses of facts merge them in more general features. And in favor of very enlarged observations we have the testimony of Herschel, that "It is only by condensing, simplifying and arranging the acquired knowledge of the past that posterity can be enabled to avail themselves fully of the advanced standpoint from which they start."

To collect observations is a trade which must be learned, and not divined; nor can we trust others to observe for us. And to observe well, we must not observe hastily; but to re-examine an object as if presented the first time is the only way, we are told, to rectify errors. But the professional man, though he carries on a certain inductive process in his mind which results in establishing the conclusions of his daily experience, has no leisure for the requirements of statistics. Practitioners are all isolated; but general facts are required. And, in some respects, the present is a favorable time to get them. For the modern school of observation, with its more accurate methods of investigation by physical signs, the microscope and test-tube, has a tendency to discriminate more nicely between diseases. Differential

diagnosis, one of the most essential elements in statistics, is therefore more exact, as well as of easier application. And where the diagnosis is very uniform, the limits of variability in our numbers are small; in such diseases as smallpox and tetanus, for example, but a small number of facts need to be observed to settle definitely our diagnosis, or, in fact, our treatment.

Although the numerical method had been verbally recognized for ages, it was never practically tested and exemplified until the sceptical mind of Louis had its attention drawn to it. From his youth until he had attained the age of thirty-three years, M. Louis studied and practised in Russia. Coming to Paris, he became a disciple of Broussais, whose theories were then in full tide of popularity. But soon doubting the accuracy of his results, he resolved to devote himself entirely to *observation* for the purpose of trying to settle some of the many uncertainties in medical science. To obtain an extended field for his observations, he entered the Hospital la Charité, as the clinical clerk of Chomel. He gave up all private business; and for *seven years* devoted himself to rigorous and impartial observation. Ridiculed at first, as soon as a numerical analysis of his facts could be made, he was admired and imitated by the French school.

Whatever we may think of this method, we can but admire his perseverance. There can be no doubt that he was the most careful, impartial and honest observer whom our profession has seen. He was no specialist, and had no preconceived ideas to verify, or *a priori* views to establish. No one who has, will observe seven years before reaching a conclusion. He studied all the functions during life, and examined all the organs after death. He analyzed his

facts, and submitted them to a rigorous comparison with all analogous diseases. Special and characteristic symptoms, he held, could only be found by comparison.

Even Sydenham said, that the natural phenomena of disease, however minute, must all be noted. And to establish the natural history of disease the method of Louis holds out the most flattering promises. His two great series of observations on Phthisis and on Typhoid Fever, have been long since well introduced by our native translators to the profession here. These two works, together with his researches on Yellow Fever, have not only established the fame of their author, and of the numerical method, but have aroused a hearty co-operative observation throughout the medical world, which, although it may have unduly exalted statistics, has not been without good effects. For some very important empirical facts were early developed from the method of Louis.

Such are the quite positive conclusions that tubercles, in any organ of the body, after the age of fifteen years, involve their presence in the lungs; that chronic peritonitis, too, indicates pulmonary tubercles; that phthisis so often commences in the upper lobes, that we have been led to call those cases where the indications of its presence are found first at the base of the lungs, the *anomalous* development of tubercles. Again, how valuable is the knowledge that bronchitis and pneumonia oftener begin in the lower lobes, and that the former is mostly found in both lungs at once, but the latter only in one. No theory, and no speculation could ever have led to these results of numeration and averages. Such spontaneous creation of laws must have escaped our reasoning, because they do not agree with any of our preconceived opinions. Yet our ignorance of the conditions on

which they depend is no bar to their utility. Although, then, the want of experiment, the presence of causal relations, from which we cannot disencumber facts, and the influence of various unknown powers modifying the phenomena of disease, must all moderate our expectations of the benefit of the numerical method, yet we have some useful results which cannot be done away with. So, too, in the typhoid affection, we find the characteristic lesion of Peyer's glands, the rose-colored eruption, the lassitude, the bleeding from the nose, the tympanites, as well as other pathognomonic symptoms, distinguishing it from typhus, marked out for us by the numerical method, not as invariable, but as present in the majority of cases.

So much accuracy has been conferred upon the student of medicine by physical signs, by chemistry, the microscope, and, to a certain extent, by the numerical method, that it has been asserted, that even Sydenham would have been but a smatterer beside the modern medical graduate. Yet, with all this, we venture to say that there have never been, and probably never will be in our profession, men of greater natural powers of observation, and of description, than Hippocrates, Sydenham and Hunter, nor any who made better use of the light which their times afforded them.

Such a tendency has been awakened in later times to extend the numerical method to all branches of medical inquiry, that our periodical literature overflows with statistics, and every hospital annually tabulates the results of treatment. This is as it should be. And if we are often called to notice fallacies in the results of statistics, we can also record cases of the truly scientific employment of them. Such are to be found in the statistics of insanity, in the recent work of Messrs. Bucknill and Tuke on "Psychological

Medicine"; and in a very carefully tabulated "Consideration of the Etiology of Continued Fever," by Charles Murchison, in the *Medico-Chirurgical Transactions*, Vol. XXIII, 1858. These leave nothing more to be asked from the careful employment of the numerical method, and carry its results as far as they are capable of going.

Louis himself mentions, as striking proof of the corrective tendency of the numerical method over the approximative one of simple experience, that, according to Corvisart, dilatation with thinning of the walls of the heart is common; but that, on counting in his book, only one case was found. So, too, Bertin and Bouillaud make the same assertion. Yet, in forty-five cases of heart disease observed by Louis, no instance of it was seen. Laennec, also, says that ulcerations of the trachea are common in phthisis, but uncommon in those who have not tubercles; yet, on numerical analysis, the very reverse is found to be the fact. But if this is sufficient to show the superiority of tabulated to remembered observation, it also indicates that morbid anatomy affords a much more profitable field for the numerical method than the uncertainties of pathology can furnish. Both, indeed, must be as much superior for its application to therapeutics, as the science is superior to the art of medicine. For the additional uncertainties of treatment must still more prejudice its results.

Medicine has two provinces, to cure, and to prevent disease. The latter, though by far the most important, has ever been thought an inferior department, and been studied less than the former. Yet by how much is prevention nobler than cure! And it is in this department that most real progress has been, and can be, made.

And here we may find the most profitable, as well as the

most certain application of the science of medical statistics. Etiology, as affected by vital and hygienic laws, has made more progress by the use of the numerical method, than in other ways.

The influence of a certain miasm, in producing intermittent fever, is so constant and invariable, that, like the contagion of smallpox, it requires no figures to prove it. Some few morbific agents are so constant as to need no calculation.

But it is the more doubtful ones that vital statistics have peculiarly enlightened. Such are the causes of typhoid and typhus fevers, of phthisis, of the spread and permanence of cholera and dysentery, etc. The etiology of continued fever from bad drainage, cesspools, and other poisonous influences, has been very well illustrated by the treatise of Dr. Murchison, before referred to. So, too, the returns of emigration, the reports of prisons, and the mortuary averages of over-crowded localities, have done much to indicate the way of prevention of typhus fever. Phthisis claims a much wider range of influences. But cholera and dysentery have, in later epidemics, been strikingly increased or diminished by certain local hygienic influences. In the localities most advanced in hygiene, their rate of annual mortality has steadily decreased. Vital statistics are here invaluable. And we can well believe that "if the attention of society were once given to these points, the saving of life would be such as would not only modify our tables of mortality, but affect the fortunes of nations."

It is very true, also, that the general tendency of the use of statistics is to discourage *a priori* conclusions, and that they tend to exactness, both in the observer, and the facts observed.

Yet we can hardly afford to substitute, in all cases, mathematics for logic; arithmetic for induction, or calculation for reason, as M. Louis has been accused of doing. Even La Place styles theory "common-sense applied to calculation"; and adds that reasoning, logic and induction are as useful in medicine as numbers. Such a method has been styled *eclecticism* by its author (M. Double); and, as an opponent to Louis, he sums up his argument as follows:

"Individuality is an invariable element in pathology; therefore every exclusive theory is absurd in pathology, and every absolute method repugnant to therapeutics. Numerical calculations, open to many sources of fallacy, are in no degree applicable to therapeutics."

A good deal of force is to be found, in opposition to the fallacy and the merely approximate nature of the numerical method, in the certainty derived from that mathematical formula known as the *calculus of probabilities.*

Since the use of a very large number of observations, in every case, is impracticable, how shall we know what value to attach to statistical conclusions derived from a limited series of facts only?

By the calculus of probabilities; which must be received as demonstrated authority by those who do not choose to study it mathematically. This method proves to us that the probability of a given event's happening does not exactly coincide with the actual number of times it has been observed to happen, but varies between limits somewhat greater and somewhat less than the number observed; and that these limits, moreover, are wider in proportion as the observations are few, and approach nearer as the observations become more numerous. We subjoin the mathematical

formula, which determines these results, taken from the work of M. Gavarret, by Dr. Bartlett.[1]

To take an example, and one from Louis himself. He has given, as the result of his treatment of 140 cases of typhoid fever, 52 deaths, and 88 recoveries: $52 + 88 = 140$. The mortality, therefore, might be supposed to be represented by $\frac{52}{140} = 0.37143$. Hence we should judge the mortality of typhoid, under the treatment of M. Louis, to be, approximatively, 37 deaths in 100 cases, or about .37 per cent.; a little more than one-third.

Yet by using the calculations referred to, we shall find that the mortality may vary between the limits of

$$.37143 + .11550 = .48693, \quad \text{and}$$
$$.37143 - .11550 = .25593:$$

or approximatively, between 49 and 26 per cent.

In other words, that, by employing precisely the same treatment in a large number of cases of typhoid fever, we may lose from a quarter to one-half of our patients; and not one-third, as stated by M. Louis.

So, too, in comparing *any other* method of treatment with that of Louis, the aggregate sum of the conditions or circumstances remaining the same, it cannot be considered certain that the method is better or worse than his, unless the difference in the result exceeds these possible limits.

[1] If a represent the number of times that one of two events (call it A) has happened; b, the number of times that another event (B) has happened, and c represent the total number of observations collected, so that a plus b equal c; then the number which expresses the observed frequency of the event A, is not the true number, but merely an approximation to it, more or less close as the number of observations is greater or less. That number will, in any case, lie between

$$\frac{a}{c} + 2\sqrt{\frac{2.\ a.\ b.}{c^3}} \quad \text{and} \quad \frac{a}{c} - 2\sqrt{\frac{2.\ a.\ b.}{c^3}}$$

or, at least, there are 212 chances to one in favor of its being comprised within those limits.

For to show the advantage of greater numbers of observations, we will take the following case:[1]

Let us suppose that 500 cases of a given disease have been subjected to a given treatment, with the result of 100 deaths, and 400 recoveries; and another 500 cases of the same disease have been subjected to a different treatment, with the result of 130 deaths, and 370 recoveries. In the first class, the ratio of mortality is as 20,000 to 100,000; in the second class, this ratio is as 26,000 to 100,000; the difference between the two being 6,000 in 100,000. An application to these numbers of the law of probabilities shows, that the limit of possible variation is equal to 7,508 in 100,000.

We cannot reasonably conclude, therefore, that the first method of treatment is better than the second, because the difference in the result *falls below* the limit of possible variation by the calculus of probabilities; a variation which may be the effect of chance. The number of cases is not sufficient for the answer sought. But, by extending our observation to twice the number of similar cases, in which the ratio of mortality remains in each class the same, we find the following results: The limit of possible variation, ascertained by the calculation of probabilities, when applied to a thousand cases, instead of five hundred, sinks from 7,508 in 100,000, to 5,306 in 100,000; which is *surpassed by* the observed difference in the ratio of mortality, this being as 6,000 in 100,000. Here, then, we have a positive demonstration of the superiority of the first mode of treatment over the second; and this demonstration got solely by increasing the number of our observations.

These calculations, it should be remembered, have nothing to do with the nature of the facts observed, but solely with

[1] Bartlett's Philosophy of Medical Science.

their number. As far as they can be carried into medical investigations, they are, therefore, invaluable. We have before attempted to show why they are not generally applicable. And it must be evident to all, that the great difficulty is in getting strictly comparable facts, and enough of them. For the mechanical exactness of the numerical method makes one suspicious of it, when applied to the notoriously imperfect science, and still more fallible art, of medicine. Comparable facts may be employed, in which the sum of possible causes remains the same; that is to say, which are comparable with regard to those influences under our control. If the degree of variableness of aggregates be limited by the calculation of probabilities, the individual facts composing the aggregates may be fixed enough to be comparable.

But the aggregate of possible causes must remain invariable; otherwise the whole calculation falls to the ground, or the law will be modified by the new element which has been introduced.[1] Thus, in 1824 and 1825, the number of legitimate births in France amounted to 1,817,572. Of these, 939,641 were male, and 877,931 were female. During the same period, the number of illegitimate births was 140,566. Of these, 71,661 were male, and 68,905 were female. Among the legitimate births, the proportion of males is as 51,697 to 100,000; while, among the illegitimate births, the proportion is only as 50,980 to 100,000. Now the difference might have amounted to 391 in 100,000 births, without surpassing the limits of the law of probabilities; but it really amounts to 717 in 100,000 births. Some difference must exist, then, in the sum of the possible causes to explain this. And this difference can only be found in the fact of legitimacy, or illegitimacy. In the same way is to be ascertained

[1] Elisha Bartlett, op. cit.

the law of the average number of children born to each family. But here, also, changes in the physical, moral, or sociál condition of the people may alter the sum of possible causes.

Therefore, as a general deduction from the above, we have the following rule: Each series of relationships and phenomena must be fixed enough to be comparable; must consist of large numbers; the limits of variability must be determined by the calculation of probabilities; and the sum of possible causes must continue uniform. The law will be positive in proportion to the completeness of the above conditions.

Yet, with all these discouraging requisitions, the faculties of comparison and generalization still remain divine attributes, and those which proudly distinguish the human intellect from the instinctive and ever-uniform acts of the brute creation. If the vastness of the observations to establish a law must bear a fair proportion to the vastness of the circumstances controlling, or at least concomitant, under which the phenomena occur, yet we should consider that, in proportion to the complexity of the phenomena, is augmented the number of relations in which they *may* be surveyed and observed. All practical expedients and empirical rules are not to be neglected because they have not been rigorously defined and limited by the numerical method. For all common rules of the medical art have been ascertained and established by a series of observations of such vast extent as to compensate, in a great degree, for the absence of the other conditions of mathematical induction. The benefits of opium in pain; of mercury in secondary syphilis; of quinine in intermittent fever, or of arsenic in the papular or squamous affections of the skin, have had

the nearly unanimous testimony of all observers in their favor, for successive ages.

And the same thing is true of most of the generally admitted rules of practice. They rest upon the concurrent testimony of immense numbers of witnesses, and of an almost indefinite number of observations. Here, then, we have an instance of the value of simple experience. But it must be the experience of multitudes of observers, and of long series of years. Both here, and in the result of the calculation of probabilities, the uncertainty is rendered so unimportant as to be practically disregarded. The corrective influence of multiplied observation is, in these instances, analogous to that geometrical problem by which we can indefinitely approximate the sides of a polygon, inscribed within a circle, to the circumference of the circle, until it shall be impossible to distinguish the one from the other; and the polygon has, to all intents and purposes, become a circle. Yet here, after all, we fail of the certainty of demonstration, and the result is, at best, *approximate.*

So the most careful methods which we may apply to the solution of medical problems are not only often utterly fallacious, but when most perfect, like this weaker part of geometry, are still inexact.

The inherent contradictions of medical science have been enhanced by the most opposite theories in all ages.

All the theorists say to the practitioner at the bedside, "Do not try, but think; reason, argue, deduce!" Empirical Hunter said, "Do not think, but try!" So the modern disciples of the numerical method would say to us, "Neither think, nor try; but *calculate!*"

Meanwhile the patient dies. The average mortality, not

only of the whole race, but of many acute diseases, remains unchanged century after century. Truly, when we consider the fallacies of medical science, its confusion, its contradictions, and its impracticable theories, as well as the weakness of the medical art, and the little which it really can do; and when we contrast, with these humiliating considerations, its high aims, and exalted calling among the other branches of human knowledge, we may well say, as has been said, with epigrammatic brevity, "La médecine est la plus noble des professions, and le plus triste des métiers."

Yet the truly physiological and scientific practitioner, trained to the finest edge of acumen, and, above all, taught to observe everything, is the man for the times. For the study and analysis of phenomena, and their relationships, and not the discovery of any general law like gravitation, marks those who are the Newtons of medicine. So did Hippocrates, Sydenham and Hunter, Laennec, Andral and Louis. And so should we all. The science of medicine wants facts; comparable, numerous, well observed, carefully arranged, minutely classified, and acutely analyzed. But little reward awaits those who collect them. He who devotes himself to the science of medicine must expect little sympathy from the mere votary of the art.

His reward lies in posterity, and the test of his conclusions must be in the future. No other agent but the lapse of time can rightly estimate the varied elements which constitute the science and the art of medicine. This alone can finally arbitrate between the claims of statistics, and of the other methods of observation. So says Bacon:

"RECTE VERITAS TEMPORIS FILIA DICITUR, NON AUCTORITATIS."

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IS THE STUDY OF MEDICINE A LIBERAL EDUCATION?

Among the Greeks, a temple was built and dedicated to Hippocrates; and in the Middle Ages, Ambroise Paré, was welcomed in a besieged city, as equal to a strong reinforcement by troops. But in modern times the pseudo-sciences and the various "pathies" have thrown discredit on medicine, while the admitted uncertainties of the art have belittled the advances in the science of healing. It is, however, precisely here that we are justified in showing the sharp contrast with the modes of learning even fifty years ago; in claiming that medicine as now studied is a liberal education; and that a well-equipped medical school is equal to other institutions of learning.

The times have changed, and we with them, since the days of Dr. Samuel Johnson, when he defined in his dictionary the humanities, as "philology, grammatical studies, *humaniores literæ*." Few would now claim for a purely classical education the name of a liberal one, to the exclusion of the study of the natural sciences. The immense debt of civilization to modern advances in technology, the adaptation of new laws and new forces in nature to our daily use and our daily needs, properly assert the right of purely scientific pursuits to be reckoned the equal of the humanities, which formerly were represented only by languages and literature. Yet modern medical study includes both the languages and

science. Latin is interwoven with anatomy too intimately to be disentangled. Botany and pharmacy equally require a fair acquaintance with this ancient tongue. Greek is more used in scientific nomenclature, and above all in the specialties of medicine, than in modern literature. German is indispensable to modern medical investigation; and so also is French. Ancient and modern languages, then, four in number, besides the vernacular, are required elements in a medical education to-day. In this respect the medical school is closely allied to the purely classical college. But even without this, we may justly claim that medicine, as now studied, requires an intimate knowledge of science, and also that the doctor, next to the naturalist, has the cultivation of his powers of observation carried higher than in any other profession. The *vexatio naturæ* of Bacon, the test of experiment, the clinical observation of disease, develop the highest faculties, and *are* a liberal education.

The study of medicine is wholly by *observation.* The practice (or art) of medicine is the result of *experiments.* Medical science is then strictly *inductive.* Theories of medicine may lead to *deductions*, often to false ones.

Let us attempt to define the terms observation, experiment, induction, deduction.

Observation: What we learn by using our senses; looking, hearing, touching, observing.

Experiment: The trial of anything; something done to discover an unknown effect.

Induction: To generalize from observation and experiment.

Deduction: A consequence from principles premised.

For example: Watt *observed* that boiling water turned to steam; that steam lifted the cover of a kettle; he *experi-*

mented to see if it would move other objects; by *induction* he generalized the law of the expansion of steam. Theologists premise that God oversees the world; they *deduce* from this premise the principles of religion.

Says Mr. Buckle: "Science is the result of inquiry; theology is the result of faith. In the one, the spirit of doubt; in the other, the spirit of belief. In science, originality is the parent of discovery, and is therefore a merit; in theology, it is the parent of heresy, and therefore a crime. . . . The popular tendency of induction is obvious: for one person who can think, there are a hundred who can observe. . . . Facts seem to come home to every one, and are undeniable. Principles are not so obvious; and being often disputed, they have, to those who do not grasp them, an unreal and illusory appearance, which weakens their influence. Hence it is that inductive science, which always gives the first place to facts, is essentially popular, and has on its side those innumerable persons who will not listen to the more refined and subtle teaching of deductive science. Hence, too, we find historically, that the establishment of the modern inductive philosophy, with its varied and attractive experiments, its material appliances, and its constant appeal to the senses, has been intimately connected with the awakening of the public mind, and coincides with that spirit of inquiry, and with that love of liberty, which have been constantly advancing since the sixteenth century."

The novel, recent and enlarging use of instruments of precision, together with the progress in physiology and microscopy, have been the great factors in changing the whole scope of medical instruction.

To learn medicine, we begin to study: (1) chemistry, or the composition of inorganic and organic bodies; (2) the

dead man, healthy — or anatomy; (3) the dead man, sick — pathology; (4) the living man, healthy — physiology; (5) the living man, sick — clinical medicine. Many collateral sciences are also studied, as physics, botany and others.

Chemistry has revolutionized the art of living; and has equally revolutionized the practice of medicine. Bulky, inert or incompatible drugs have been resolved into the potent alkaloid, which is both cleanly and palatable. The chemical changes undergone by remedies in the complex laboratory of the human body have also been carefully studied. The fluids of the body have been analyzed. General chemistry and medical chemistry require long courses of months spent in the laboratory, before the student is permitted to advance to other branches.

Anatomy, that fascinating study of the structure and complex machinery of life, is studied on the dead body. No pursuit is more ennobling; none reveals more plainly the exquisite mechanics of living structures and the design of our Creator. So long, so labored, so minute have been dissections, that it has been said that anatomy was learned out, and there could be nothing new to discover. So far from this being true, the microscope has taken up and prolonged our search; and histology, or the study of tissues and cells, has opened up a new world of investigation. Anatomy is studied in our medical school one entire year, half a second year, and there is a daily exercise in it for three and four years.

Pathology is anatomy altered by disease. While descriptive anatomy, or macroscopy, is now supplemented by microscopy, the gross outlines of the sculptor, by insight into the minutest tissues; so in pathology, this insight penetrates the deepest crypts of disease, maps out growths, describes cell-

arrangement, and in bacteriology pursues the parasitic germ to its home in the tissues and describes its habits and its *habitat*. Creative cellular forces are traced back in embryology to the protoplasm and the primal cleft.

From anatomy and pathology grows surgery. And who can measure the future of modern surgery, except by contrast with its vast advance in the last twenty years? The germ theory of disease and the use of germicides or antiseptics have changed suppurations to painless healings, banished many *opprobria* and failures of operations; and, together with anæsthesia, have rendered the surgeon bold, accurate and safe in many novel operations on the abdomen, the viscera, and the brain. The surgical field thus enlarged; the focus of surgical observation brought down to infinitesimal minuteness; counting blood globules; estimating white cells; resolving bacilli, — all this has to be learned, and learned by observation and practice, in a modern medical education.

Physiology, the science of nature, or of life rather — the knowledge of function, of use, of habit; in health, in disease — has also been developed almost as fast as the knowledge of physics has been enlarged in physical laboratories. Experiment is the path of physiology; along this path she moves steadily upward; and by experiments on lower animals, medical practice is most rapidly advanced. No one unfamiliar with it can realize the extent of the appliances and details of a modern physiological laboratory. Here, then, the medical student has a vast field of study.

Just as the great artist must study and copy the human face and form as his most difficult lesson, if he would excel in any department of painting, so man offers to the medical observer the most complex and least scrutable problem. He

lives, grows, decays, revives, assimilates, excretes, gains, wastes, — all at the same time. Cells travel, reside, procreate, develop, decay, form healthy or diseased tissues, side by side. Chemical interchanges, vital forces, nervous influences, all combine in life. Mental processes influence bodily ones; and all these are to be weighed, counted, balanced, measured, in estimating the health or the sickness of the individual. The trained eye, the educated ear, the erudite touch, must all be guided by prolonged clinical experience, to constitute the medical observer, the true physician. It is in our great hospitals and dispensaries that this highest educing of the faculties must be practised by the medical student.

Modern science has offered to the observer numerous instruments of precision to guide his observation. The clinical thermometer is the safety-dial of diagnosis. The stethoscope magnifies the sounds of the heart and lungs, and makes plain slight vibrations otherwise inaudible or unnoticed. The ophthalmoscope illuminates the bottom of the eye and the retina. The laryngoscope reveals the vocal chords; the endoscope numerous cavities, which are also made visible by the electric light. The microscope extends the natural eye of the observer to the cellular basis of all the tissues. Synthetic chemistry compounds the excreta of bacilli to arrest the progress of the germs themselves.

If we add to all this the tendency in medicine, as in all pursuits, to specialize, we may realize how every field must be magnified by minute research.

Besides, medical studies form close partnerships with the law, in medico-legal questions, and in sifting crimes. The analysis of poisons, the recognition of blood, the determination of the time and the cause of death, the weighing of

accountability, the estimation of mental competency, — all are settled by the medical expert.

In the noblest field of all, preventive medicine in hygiene, modern medical education is making the greatest progress. To cleanse milk of tubercle bacilli, to detect filariæ, to dispose safely of drainage, to purify water, are the pressing scientific as well as practical problems always testing the knowledge and the keenness of the medical observer.

Just as colleges, as they broaden, aspire to give advanced instruction, so, also, the medical school is providing post-graduate and advanced courses for original research, and for specialized study.

The treatment of disease has always been considered the highest attribute of the physician. In this department all his previously acquired knowledge is grouped, classified, utilized. No vaunted specific is left untried; the earth is ransacked for remedies; and they are all tested by experiment.

Can we deny, then, to the study of medicine its place among the noble sisterhood of the sciences of civilization? Her present methods no more resemble older ones than the steamship or the electric light of to-day resembles the galley of the Roman or the *lucerna* of Pompeii. What can be a more liberal education than drawing out the faculties of observation, learning by experience, comparing and generalizing by induction, as we do in the medical school; but demanding, as a prerequisite, a knowledge of English, of Latin, of physics, either German or French, and some mathematics; and considering, as best of all, a preliminary mixed, classical and scientific, academic course and degree?

MEDICINE AS A TRADE.

I PROPOSE to speak to-night of medicine as a trade; and did I not feel reasonably sure that your patience would hold out so that you would hear the suceeeding lecture next Thursday, I should be very unwilling to give this one. This is but a prelude to what is to follow, and is as low as I hope that may be considered high, and as ignoble as that is noble. Some Frenchman, with a certain Roman terseness, has said that "medicine is the noblest of professions and the saddest of trades." As a trade, it certainly is a very sad calling. It is not conducted in a business-like manner. The modes in which the mere mercenary doctor, who is a poor creature at the best, manages to practically commit suicide from a business point of view, and to hinder his own advancement, are certainly very striking. We hear a good deal said nowadays about the honest dollar. The doctor has an honest dollar, if he can obtain it. We hear, also, a good deal said about the rights of labor; and some of us think, that, perhaps, the laborer is now getting rather more than his share of the goods of this world. At any rate, the ordinary laborer has reduced his hours of labor to eight hours, and the hours of the doctor, as a laborer, vary anywhere from twelve to sixteen, and sometimes to twenty-four. It being well understood that if he has twenty-four hours, during which he has been on a stretch of continuous work, the next twenty-four hours are not going to bring him neces-

sarily rest; but after he has been up day and night, that the next day's work begins exactly the same.

Now, in considering the profession of medicine from the point of view of a trade, the first practical question which we naturally ask is, "What does it cost to become a doctor?" By a doctor, I mean one who is well educated, and well adapted to cope with the difficulties of practice in a community. It costs, in the first place, practically eight years of labor either in a college and then in a medical school, four years in each; or else, if one does not go to college, then in some high school or academy, which consumes about as much time. We find now that the average medical student is turned out upon the world as a graduated doctor when he is from twenty-five to twenty-six years of age. If he has had the advantages of a college education and the medical school for four years, he is necessarily of that age. If he has not had those advantages, if he has not been able to go to college, then, in all probability, he has been kept back by poverty, which has obliged him to study more slowly, to work as he goes on, so that the time of life when he enters upon his professional work is quite as late as the more favored young man, who has had a university education. Eight years, by moderate computation, would cost certainly as much as eight hundred dollars a year, and that would bring an expense of six or seven thousand dollars. Many young men would expend a thousand or twelve hundred a year, and that would bring it to somewhere from eight to ten thousand dollars, in necessary fees. The large number of books to be bought; the instruments which are now used in the practice of medicine as well as of surgery, and which the student is obliged to have; and the various incidental expenses which keep growing as science grows and as the

study of medicine specializes more and more, — all these things would necessitate an expense of from six to ten thousand dollars. We will call it ten thousand dollars; eight years of study; and the young doctor twenty-five or twenty-six years of age. In any other business of life, if he had expended that number of years and that amount of capital, he would expect to be placed in circumstances where he would develop rapidly and make money with certainty, provided he succeeded in the business he had undertaken. But this is the doctor's plant, so to speak; this is the cost of his education. Having obtained this plant, it remains to be seen how far he can grow; and whether the circumstances which surround him in life are favorable to a rapid growth, or not. I would say here that it seems to me that the expenses of the doctor are about the same in the early years of his life whether he is in a large city or in a moderate-sized country town. In a large city he is obliged to expend more for rent and to live in a somewhat more luxurious style; but in a country town he cannot live without horses and carriages, and is obliged to keep from one to three, early in his practice. This he is not obliged to do in the city, so that the expenses rather balance themselves.

What does he do, what can he do with this costly plant? He has expended this amount of money; he has lost this number of years of his youth; and he is now ready to begin. In all other ordinary business trades the young man who is entering upon them advertises himself in some way: the doctor cannot advertise. Why cannot the doctor advertise? Because if he advertises, it is considered that he advances himself above his fellows, that he makes pretensions of being better than they, of being able to cure more people than they; and this, if pushed to a certain extent, flavors of

quackery. While it is very injudicious for him to advertise, it is also improper for him to do it. If he makes any discovery he cannot own it, it belongs to mankind. Every one else who makes a discovery patents it, or has a trade-mark, or has some exclusive right of possession. Not so in medicine. Of course, the humane side of what we call our profession, and not our trade, obliges us to give whatever belongs to mankind freely to it, so that other doctors can use it on their patients just as much as we use it ourselves.

The doctor, so far as I know, is the only person who gives away something — which is his knowledge and his time — for nothing — which is his service for the poor; at any rate he is the only person who pursues this daily to any very large extent. He gives away something for nothing, in the sense of giving away something which has cost, and receiving back no absolute money in return. He can be sued for this gift; he can be prosecuted for what he gives away; and that is one of the peculiar paradoxes and hardships of our profession.[1] In other words, giving gratuitous services to the pauper who has fallen and broken his leg does not prevent the doctor from being sued at law, if the case does not prove a success, although he put forth his best efforts. Here, then, it seems to me is the one instance in the world where a person can be sued for what he has given away — his knowledge, his time, his skill, his best efforts; and he has no way

[1] "If a patient applies to a man of *different occupation or employment* for his assistance who either does not exert his skill or administer remedies according to the best of his abilities, such person is not liable in damages, but if he applies to a *surgeon*, and he treats him improperly he is liable to an action even though he undertook *gratis* to attend the patient, because his situation implies skill in surgery. . . . The law has no allowance for quackery. It demands *qualification* in the profession practised — not extraordinary skill, but that degree which ordinarily characterizes the profession." — *See McClelland on Civil Malpractice*, pp. 193–4.

of defending himself except to hire a lawyer at considerable expense to prove that he is right; and to justify himself in the eyes of the world, at a loss of a considerable portion of his fees, for months or years.

He cannot sue others very well for his debts, unless in exceptional cases. Why not? Because that savors of oppression. It is the taking advantage of people's misfortunes; it is taking advantage of their sickness and their weakness; and they frequently, of course, put it on the ground of poverty — that they are unable to pay; and if a suit is brought by the physician, although he may recover it, it is a question whether it is useful to him in the long run, and whether it does not in the end injure his reputation; and whether he had not better put up with the loss, unless in certain circumstances of aggravation where his character is attacked. If the patient complains, if the patient threatens a suit, then is the time for the doctor to sue for his bill; for by no other means can he contend against an adversary so mean and poor as one who attacks him in this way.

There are also a good many other ways in which the physician is cheated out of his just dues. As long as it is necessary (and it probably always will be necessary) that the doctor should have a sliding scale in his prices to his patients, if he is a merciful man he endeavors to accommodate his fees to the patient's class. He often misjudges him, thinking him poorer than he is, rather than richer; and it often happens that he is deceived in this way, and does not charge the patient what he can really afford to pay. Furthermore, the public are willing to take advantage of the sliding scale, and say, "If So-and-so pay such a bill I cannot afford to pay any more." So in this way a good

deal of what is justly due to the doctor may be gradually filched away; and yet there is no remedy for it, because it is not decent, not proper, that he should charge the same fees to the poor laborer as to one who is wealthy.

He is also considerably imposed upon in public duties. For instance, although he escapes by law being called on a jury, and is free from that loss of time and annoyance, he is obliged to go to court on every possible summons about some little case of no consequence, where his testimony is important to the individual who brings the suit; consequently he goes to court and is obliged to waste his time; and although he may not be obliged to give an expert opinion, yet he is obliged to go for a fee which is inadequate. The loss of business is not to be measured by the direct loss of time, but by what may have happened in that time, how many people may have been angered or disappointed at not finding you at your office at your usual hours when you advertise to be there, and when you are expected to be at home. I say, advertise by your card, but not in any other way.

Then again, there are a great many forms of papers and certificates which the doctors feel obliged to sign in order to satisfy their patients, for which they ought to receive a fee. Notably is that the case with the great life insurance companies. The life insurance companies have more money than all the banks together, and yet some of them do not hesitate to extract a certificate from the doctor with regard to the death of some patient who is insured in their company and of whom he was the family physician, and as his testimony is of value to them they send their agent, and the doctor signs the paper; and as he does not know what circumstances the patient was in, he does not like to press

a claim against the family itself; and sometimes insurance companies refuse to pay for those services. No service that he renders in returns of contagious diseases, births or deaths ought ever to be paid for or ever to be charged for; the doctor does not expect it; and it is a part of his duty to the community that he should give those services freely.

Now the young doctor having started with his plant, and his loss of eight years of time, begins to seek for patients; and the first great injury that is done him in immediate practice is the fact that a large number of those people who might otherwise employ him are tempted to go to hospitals and dispensaries and receive gratuitous treatment. Many of them need it, many of them do not need it; and it is almost impossible for hospitals and dispensaries to discriminate between the two classes. Many of those who go neat and clean are the poorest; and many miserable and drunken creatures have money at home, with which they might well pay the doctor. This, of course, inflicts an injury on the young doctor; it is among this class of people that he gets his first patients. It is said, I think with truth, that in London one person in seven is treated gratuitously in hospitals. Apply that to Boston, and we should have sixty thousand patients visiting our hospitals and dispensaries. And when you look at their annual reports, and reflect how many departments there are, and how the patients are scattered about over the field, I do not think this is much exaggerated for Boston itself.[1] Especially is this so here since our population has changed.

[1] It was reported to the British Medical Association, meeting for 1896, that in Birmingham, in one year, 128,000 was the grand total treated free in public institutions. The population of Birmingham is about the same as that of Boston, namely, 500,000.

Poor people used to have a self-respect, they preferred to stay at home; the hospital patients were mostly Irish; but since the Slav and Latin nations have come in, they always expect to be hospital patients; they never mean to employ a doctor in any other way. It is their first thought when they are sick to seek the hospital, where they get the best treatment free of cost. This has made a great change in our community, and it must have made an equally great change in all our large manufacturing towns.

Does the doctor get any compensation for this? If possible, he gets attached to a hospital or to a dispensary, and he goes and gives a good many years of the best part of his life to a gratuitous service in this institution for various reasons — not wholly unselfish reasons, but considerably so — that he may see practice; that he may get experience; and that he may take other steps leading up to where he wishes to place himself in his profession. All this works to his advantage, undoubtedly; but let us consider at what a cost. The best part of his life is given to gratuitous service; when he comes round to see those patients who can pay him, he brings to them a tired brain and tired limbs; and it is not too much to say that the hospital patient gets the best service of the two. He struggles to keep up and retain all the practice he gets outside; he struggles to keep up with his colleagues in the hospital; and altogether it is a bitter effort, which in the end, no doubt, pays; but for a number of years, through his earlier life, it is a discouraging struggle.[1]

[1] I can see but three remedies for hospital abuses, and they are partial ones: First, the attending physicians and surgeons should be salaried; second, if not salaried, they should be paid by all private-room, or well-to-do patients; third a selection should be carried out by the hospital authorities between the very poor and those able to pay something, and the latter should pay *both* the

I contend, also, that the doctors, who in so many specialties establish clinics and tempt patients, and do everything to get material for instruction; I contend that they encourage mendicancy, and that they rob their brother of fees. I have no remedy to offer for this;[1] it is inseparable from the competition where a city is overstocked with doctors, all of whom are struggling to maintain themselves and to advance themselves, and this is the only way they see to do it. I only cite this as one of the business features, but not of medicine in its noblest aspects. We propose to take that in the next lesson; but to-night we take the lowest, basest and most ignoble view; we take a mere business view, and that alone; and you can see the evil that is practically done to a large number of struggling doctors. If they are surgeons, a hospital experience is necessary; if they are physicians, it gives them the best practice; if they are specialists, they cannot get along, they cannot develop themselves in their pursuit unless they have clinics of the poor upon which to work, and upon whom to show how much they can benefit others, who may call on them later, when they have obtained fame.

hospital and the doctor. The first and second measures would indemnify the hospital doctor at the expense of his brethren; because first, he alone would be paid for treating the poor; and second, he would attract the well-to-do to a hospital where board and attendance is relatively cheaper than elsewhere, and hence wrong other doctors. The third measure is partial, and experience, so far, has not proved it practicable.

[1] In our country districts there is no organized medical charity. The country doctor must attend all, but he loses less than the city doctor. Barter prevails; he gets paid in other things than money — labor, crops, wood. But in England the Mutual Medical Club and the Poor-law Union, prevail in the country as much as in towns. For despicable annual fees the doctor attends families and individuals; the abuse is a crying one and is constantly referred to in medical journals. In Paris a physician, past middle age, and said to be reputable, recently killed himself, because, as he alleged, hospitals and dispensaries had gradually reduced his income until he was very poor. There is more room and opportunity in America, still; all good doctors can get a living; but can they in another fifty or one hundred years?

As the doctor grows a little older he comes into contact with two forms of competition: one is what I will call an honorable competition, and the other is a dishonorable competition. In the honorable competition he contends, like any other man, with his fellows for such practice as he can get without robbing other people, without wronging any one; with a proper view of advancing his own interest in every legal and proper way.[1] But there is also a dishonest competition, which robs him in a great many ways. Some doctors who are not so sensitive as others will gradually take away his patients in one way or another. He, also, having no right in what he does, having no right in the property which he gives to others, having no right in his prescriptions which he gives to the sick, these necessarily become public property, and are largely repeated and repeated, over and over again, by many druggists; and if they happen to be a happy combination which suited A and B, then C and D are furnished them by the apothecaries without any fee to the doctor. It is a well-known evil, it is a very large evil, and it is a direct robbery of the doctor whose knowledge, whose brains, whose insight, perhaps whose exceptional insight, have enabled him to get up some combination of medicine that has done a great deal of good. This prescription is passed around from patient to patient, repeated over and over again at the druggist's counter; finally, after the doctor's death, is known by his name; and you will see with some of the druggists of this city the prescription of some of the older physicians advertised in their stores as a work of skill of certain old doctors who have long since passed away. So that here the doctor is robbed again; he loses

[1] Should rich men practise? The fees they receive are so much taken from the common funds of poorer professional brethren. Should they not devote themselves to science, to experimentation and to teaching?

what he has done; he gives involuntarily to the public a great deal more than he meant to. He enriches others who claim these things as specifics, place them before the public by advertisement, and vend them for more than they are worth, perhaps, but still make fortunes out of them.

There are a number whom the doctor must attend, and I mean apart from the very poor, whom he does not feel it is right to extract a fee from, or to charge. Such used to be the case largely in regard to the clergy. Such is to a certain degree the rule now. Of course, it would depend somewhat how one would feel in reference to the position of the clergyman; if he happen to be a poor country clergyman he cannot afford to pay the doctor; but there are some who are in much better circumstances than the doctor himself and well able to pay for his service. It is not customary, and it is not proper, that the doctor should charge anything to his brother physicians. They have free right to his services; and as he grows older in the profession he will find that they are more likely to consult him on account of his age and experience; hence, while his youth was considerably taken up with the poor who could not afford to pay, his age may be taken up by brother physicians who for themselves and their families wish to take advantage of the years that have passed over his head, thinking that greater wisdom lies therein, than perhaps in youth. This, bear in mind, is only spoken of in relation to the trade, and not to the profession. We should be very sorry in the profession to refuse such service to the brother physician and to the clergyman; but, as a trade, I speak of how the doctor is committing pecuniary suicide almost every day he is practising medicine.

Then, again, there are a great many anxieties for which there can be no compensation, and which the doctor has got

to count in as costing so much in nervous strain, in loss of sleep, perhaps, or perhaps in worry with regard to the future. The doctor, you must bear in mind, has to carry the burdens of all sick people; he is their friend, advisor and counsel, and if you look at it from a plain business point of view, the fact must remain that this must be counted also as a somewhat discouraging feature. He does not get and sell a piece of cloth as the tradesman does; and he does not feel that the piece of cloth that he sold is as good as it was when it came into his hands, or is just the measure, or if it is any other article of merchandise, that it is just weight, and that the transaction is perfectly honorable and that it is the end of it; and it does not matter to him what has become of that piece of cloth, and who has bought it. On the other hand, he has treated a sick person, and he has asked himself many anxious questions as to his recovery. Then, there will happen to him occasionally those terrible unexplained deaths, sometimes an autopsy not being permitted even in our present state of advancement — those sudden, unexplained and unexpected deaths — a shock as much to him as to the friends and family, often an injury to his reputation, and the cause of a great deal of criticism among his friends and patients. All this he has got to take into his estimate of medicine as a trade. It is his business. He gives out an enormous amount; he gives mentally more or less; and his services are more costly in brains and in patience and in endurance and in suffering than in any other form of the ordinary business of life.

In spite of all this, the number of young men who come forward to study medicine is as large as it ever was, and perhaps is somewhat increasing; and although all callings and professions are somewhat overcrowded, certainly medicine is as much so as any other; and the doctor has now to

contend, as he always has had to contend, not only with various irregular physicians who assume to cure people, without proper education, but he has to contend with a new class of obstacles in obtaining a livelihood, and that is in the laıge development of specialists. It is true, no doubt, that specialists are necessary ; that they would not exist if they were not necessary ; and while they are a great burden upon the patient, requiring him to employ a great many persons for different parts of his body, they are a great drawback to the physician because they diminish his patients, and they destroy what used to be the family doctor. Such a person seldom exists now except in some isolated place ; and it is owing to his isolation that he retains a large circle of duties among certain families. Meanwhile, in larger communities, where there is more friction and where specialties develop more easily, then this, that and the other are speedily called for, and the family physician gradually ceases to exist. One person attends to one class of duties and another person to another class of duties ; and you must see, that while this may bring large fees to a few persons, it must diminish the income of the great body of physicians. And this results in rendering the position of the general practitioner after he has spent his money and his years, not so desirable as it used to be.[1]

It is hardly fair, it is almost too base, to speak of the duties of the medical profession to the poor. Boerhaave said, "The poor are my best patients, for God is their paymaster." Very true. Meanwhile, although it seems almost too base to take up such a subject as this, yet if we look at

[1] The average doctor in America may count on a comfortable living if he works and has fair ability , but not on getting rich, for many doctors die poor, and most doctors lay up little. Teaching, also, is very poorly compensated in money

it from a purely mercantile point of view, we must recognize the fact that the poor in all communities are more numerous than the rest, that they have got to be taken care of; they give to a doctor a great deal of satisfaction in getting well, but they do not give the honest dollar that he has got to pay out for his rent. But, looking at medicine as a trade, the grocer does not expect to treat the poor; he may occasionally give away something, but he sells, and when he sells he expects money, and he expects to collect it on the spot. When he settles down in a neighborhood he recognizes a certain *clientele* in that neighborhood which will bring him in enough money to live on. On the other hand, the doctor, as a tradesman, if he goes and looks at a town from a business point of view, sees a large number of people in the community whom he expects to treat without pay; only they may bring him a certain popularity Now, the question is, Do they do that? They do, to a certain degree. They add to his reputation for humanity; they get him known favorably as a kind man, and perhaps, also, as a skilful man. And so practice may gradually creep on from the poor to the kitchen; and from the kitchen to the parlor; and thence through the higher walks of life.

Meanwhile, we must consider this from another point of view. When I was a dispensary doctor myself — and I have heard a great many other dispensary doctors say the same thing — while the patient was pretty poor he would employ the city doctor, but when he was a little better off he would say, "I don't wish to employ the city doctor; I will take another doctor of a better grade." Instead of employing and paying the one to whom he ought to be grateful, he is apt sometimes to employ some one else,

through pride. That is undoubtedly true. Generally things are valued for what they cost. When they cost nothing they are valued at very little. When anything is paid for, it is counted for more. This principle is carried out in a good many of the hospitals and dispensaries by charging a small fee for medicine. I will venture to say that that medicine is more appreciated and is taken with better care than if it were gratuitous. It has a kindly effect. It has a restraining effect; and while all the world, almost, will go and do some very foolish and tedious thing because they can get it for nothing, it isn't because they value it, but because it is offered to them. Mr. James Russell Lowell used to say that a person would go and sit through any amount of boredom for the sake of getting a gratuitous lecture. I have no doubt that is true. But when the poor seamstress, or laborer, or his wife, has become very sick with some chronic disease, what wonder, that if they can, they seek higher advice, and consider it higher because they pay for it?

This is but a prelude for what is to follow next time, to show how all his kindly instincts are fighting against the young doctor when he is struggling to get his living. Meanwhile, as Abernethy said once to a lecture-room of students, so I will repeat: looking around his class-room when a new class came in for the year, he said, "God help you! what is going to become of you all?" That might be said to-day! and yet the tide of medical students never ceases. And if they do not attempt to pursue medicine as a trade; if they take the nobler view, and pursue it as a profession; if they are willing to submit to these ignominies and worries, they will find as they go on, that there is another class of considerations which will render it one of the finest callings in the world.

In view of that great jubilee which we are going to have to-morrow; in view of that God-given ether which came to us fifty years ago, how can we regard in a base light anything that man can create or invent? When he creates or discovers, he is nearest like his Creator. How can we regard anything that man can create to relieve human suffering, as belonging to any one person, as being capable of a trade-mark, as being capable of being held from the world, when it is going to be such a blessing to the community? I believe this celebration that we are going to have will exert the most refining and ennobling of influences; and I shall hope, after the celebration is over, that if you cannot be there, you will read what is said by the distinguished men who come from different parts of the country; and that you will be encouraged to press on to that nobler field, which I hope to show you next Thursday evening.

MEDICINE AS A PROFESSION.

Medicine as a profession brings the doctor into contact with all kinds of men, women and children — of all ages, from birth, literally, to death. No other relation of life, except the family relation, is so close; and in some respects, it even surpasses that. The peculiar relation of the patient to the doctor is different from any other. It makes no difference to the doctor, when he has a case, what sort of a coat happens to cover it, or of what condition in life the patient may be. If he has a true professional spirit he sees only the sick person, and he keeps before him the only idea which can properly belong to the medical profession, — that his business is, first, to try to relieve suffering, and cure sickness; and, secondly, if he cannot fully accomplish those things, at any rate to prolong life and render the close of life and the approach of death more easy. In that way, in some respects, his calling is, I think, even more sacred than that of the clergyman; because it deals with tangible and known things that we all can realize; so the good that he does is soon apparent; the mistakes that he makes are soon plain to be seen; and the reproaches that he may make himself for those mistakes are sometimes very bitter when he realizes the truth. Thus thrown into such very intimate relations with humanity, he becomes a participator in all its secrets; and he frequently knows all the secrets of the family, and even the secrets of certain portions of the family that are not known to the rest.

He is, so to speak, a father confessor to all classes of human ills and sicknesses, and, of course, should hold it a point of honor to keep these secrets. It used to be the rule that a physician should take oath on beginning to practise his profession that no secret imparted to him in the sick-room should ever leave it.[1] This rule is as important to-day as it ever was, perhaps more so; because in these days of modern publicity, when there is no private life, who shall be the guardian of these important interests, if not the physician and the clergyman — the two forms of confessor to whom human beings go in their misery to tell their sins, their sorrows or their physical infirmities. What, then, shall we think of the law, which, in the State of Massachusetts, does not protect the physician in court in the keeping of secrets, but obliges him to tell them in certain circumstances, under penalty of imprisonment? It seems to me that this is a shame to Massachusetts, because it is in this State and some others, but not in all the States in the Union, that this condition of the law prevails. While here, as I am told by those who know the law, and as I have experienced in court, the physician is not protected in refusing to divulge the secrets of his patients. He may absent himself. He may, if he thinks proper, tell lies; but that is perjury. Certainly this is not the way in which the law should be respected and obeyed; for where the people make the laws, they should be amended, but not violated. A number of the States of these United States protect the doctor in the possession and retention of family secrets. Some States go farther, and being more advanced in humane legislation

[1] The oath of Hippocrates also forbade the taking of fetal life. It is the doctor's business to save life, not to destroy it. No occasion should tempt the physician to destroy an infant except to save the mother. Whether, under proper restrictions, he might be allowed to hasten the exit of the really moribund sufferer, and promote euthanasy, is a question.

than we are, make it criminal for the doctor to reveal the secrets of his patient in court. He is not only protected in his effort to keep them, but he is forbidden in the State of New York to divulge them; and also in seven other States. In Massachusetts, the law still reads, as I understand it, that the physician has no defence; that if the counsel or judge think it is for the best interests of the case that certain statements should be made, they must be made. No one would deny that this ought to be done in serious criminal procedures which involve life or death; but that in ordinary civil suits affecting only the reputation of the individual who, perhaps, is on trial or is forced on trial, private affairs should thus be dragged into publicity, seems to me extremely wrong. The doctor has no redress unless he refuses and is punished. I hope that the profession here will soon take steps to have this legislation changed.[1]

The doctor is a victim of the interviewer and reporter: they not only pursue the doctor, but haunt the house of the

[1] "Neither is protection extended to medical persons in regard to information they have acquired confidentially, by attending in their professional characters." — *Greenleaf on Evidence*, Edition of 1896, vol. i, p. 248, under "Privileged Communications."

Protection by common law is not extended to priests; although the Roman Church regards the confession as made to God, and forbids its revelation; and in the English Church, the clergyman telling is "under pain of irregularity." Anything told to legal counsel, however, is a privileged communication, and cannot be questioned, unless the party making it waives his rights as to secrecy. Massachusetts courts go by the common law, and oblige the physician to tell the secret confidences of his patient, and to lay bare his diseases or his sins. Not so New York, Missouri, Indiana, Nebraska, California, Wisconsin, Michigan, Minnesota — other States I have no knowledge of.

"No person duly authorized to practise medicine or surgery shall be allowed to disclose information acquired in attending a patient in a professional character, and which information was necessary to enable him to prescribe for him, or to do any act as a surgeon." — *Revised Statutes of New York*, vol. ii, p. 406, paragraphs 72, 73.

The New York statute has been held to apply also to knowledge acquired by observations of the patient's symptoms, or even the statements of others present. Paragraph 72 extends the same privilege to priests and ministers.

sick, and even the chamber of death. There is no privacy, no respect for the patient's feelings. If any person, in a public position, happens to be sick or dying, the papers want it all, and without regard to the feelings of the friends. Now, what course must the doctor take when pursued in this way? Reporters come from his own town, or from distant cities, and claim that the illness of this person, and whether he is to live or die, is of great importance to the public. Why? Because it may affect some political deal; because it may affect the stock market; certain changes may take place if he is about to die; and so on. To whom is this man's reputation and life so important as to his own family? How can the doctor presume to give away that knowledge which belongs to the family? It seems to me the only answer for a physician to make, is to say: "If you will bring me a note from the nearest relatives requesting me to give you such knowledge as I can of this patient, you shall have it; otherwise I shall say nothing; and you may place whatever interpretation you please on my silence."

There is another situation into which we are thrown, where the preservation of secrecy is doubly important, because the patient is beside himself and says things that he would not say if in perfect control of his senses. I allude to that condition where the patient is under the influence of anæsthetics, especially ether. It is an intoxicant; it is a stimulant; it incites people to talk; they do not know what they are saying; everything is exaggerated in their mind; they usually feel that they are being abused; and they frequently use very strong language, which they would not do under ordinary conditions. So also, in coming out of ether, many men, but especially women, pass into a state of hysterical excitement where everything becomes exaggerated;

and they frequently say things which they would rather not have said, and sometimes betray secrets which they would rather not have spoken of. Now here is a position in which the doctor, the nurse, and all the attendants are placed under a double bond of secrecy; here is a helpless individual whom you have reduced to a condition in which he knows nothing, and it is worse than indiscretion on the doctor's part to divulge anything that transpires while the patient is in such condition. He should consider that anything said there has not been said; that anything that has been heard there has never been heard; and that no reference should ever be made to it. If one begins to tell such things the habit grows upon him; consequently here is where silence illustrates the rule, that speech is silver and silence is gold. It is doubly so in the sick-room, where an anæsthetic has been used.

Now, we know a great deal more about their condition than the patients do themselves. Shall we always tell them the truth, or not? They wish, apparently, to know the truth, and yet they dread to know it. I mean this, of course, of quite sick people. Sometimes a patient will come into your office and say: "I have been asked to come and see you because I have a tumor here; I don't care about it; it does not make the slightest difference to me what it is; nothing would affect me. I want the truth, and you may be sure that it would not trouble me at all." Now, that is all false — all false; and you must so consider it. They do not think so; for anything you tell them will have a deadly effect. No man can bear the truth; it takes away the chances of his recovery. If he is about to have an operation, if some growth is to be removed from him, and if he learns that what is removed from him is but a temporary relief from another operation which must follow, this will prevent rapid con-

valescence, and will weigh upon him all the rest of his life. And the surgeon may be mistaken; it may not come back so quickly. Meantime you have pressed him down beyond the hope of recovery. How much worse must this be in the case of acute sickness, as in a prolonged case of consumption, where the patient having lingered along for a good while finally asks the physician what he thinks. You know he is going to die; you know sometimes it will take place in a few days or hours. Are you going to tell him? Here comes one of the hardest moments of the doctor's life. He should consider it his duty to tell the friends, but whether he should tell the patient must be left to the doctor's judgment. There are some cases where he had better lie, I think, although the patient may live only a few days. There are other cases, of course, where he should hesitate to leave him in doubt, on account of the fact that there can be no recovery, and the patient should know it if he wants to; again, he should not prevaricate too much, out of regard for his own position, as he has to protect his own reputation; and he gives an utterly false prognostication, and a day or two *shows* it false, it injures him and is the subject of a great deal of talk. But it is not right to take away from a patient any hope which may aid in his recovery.

There are cases when friends come to the doctor and say, "You know that this is going to terminate fatally?" "Yes." "You know it will be pretty soon; do you realize that unless the patient knows it and arranges his affairs, it is going to leave us beggars?" Now that is not an uncommon case; and if you can assure yourself that it is true, of course you feel obliged to speak to the patient; but if you can, try to make light of it; telling him that he should arrange his affairs, as we should all arrange our affairs and so on; yet

anything you say, at any time, will be quickly picked up by the patient, and perhaps be thought to mean more than you do mean. Here, also, is another reason why doctors should be cautious and reticent; because their stories are doubled the second time they are told, and tripled the third. Nothing that a doctor says retains its simplicity; when passed around from mouth to mouth, it is added to, and speedily grows into something entirely different from what he would have wished to utter.

I need not say, of course, that speaking in a selfish point of view, it is extremely important that in the ordinary intercourse of life the doctor should be reticent among his patients, because if he gets the reputation of giving away their private affairs, it soon injures him in the community. One who can be entirely reticent wins more respect, and retains more the confidence of all the world. So much for the doctor's immediate relation to the patient as regards his secrets, and as regards the necessity of telling him the truth when he is sick.

Now, there is this peculiarity in the relation of doctor and patient, that if a doctor once enters upon a case he does not feel that he can give it up voluntarily until the patient sees fit to discharge him; as long as the patient wishes him to go, he must go, with or without prospect of reward. If he has not touched the case, all right;[1] but if he has once taken it up, he must go on. How often this happens with a young doctor whose first patients are among the poorer classes.

[1] The doctor is not obliged to go when called; the only law which binds him is the obligation of humanity. Thus, if in an isolated community and no other physician were to be found, he might feel obliged, while he would not in a city or town where there were other doctors. Fatigue, sickness, overwork, other engagements, are sufficient excuses. Were it otherwise, he would soon die of exhaustion. He may decline, day or night; he can select his patients as he chooses; but if he goes, he feels obliged to continue.

Their means are soon exhausted, money is gone, no more money is earned, but that patient has got to be seen through, no matter if it takes a month or a year. Of course, there are cases where the patient wishes to change, and then the doctor has nothing to do but to retire. The relations of the doctor and patient are peculiar, they are so close and intimate; and they are of a most friendly and charming character when confidence is preserved; but as soon as confidence in the physician has begun to waver, then is the time the doctor is of no use. He had better be excused, and another take his place.

Consultation may be called for various reasons. In the first place it may be called, as it ought to be in most cases, solely for the good of the patient. It may be called, secondly, by the doctor to protect himself; it is wiser for the doctor, I think, if he finds the patient wavering, to suggest a consultation, as this is much better than if the suggestion comes from the patient. He may not want a consultation at all; he may feel sure of his case; he may see it all in his mind; and he may regard any further advice as perfectly idle; but at the same time, if the patient, or, as is more common, if officious friends insist on having further advice, he had better have it; and then, if he has it — with whom? Any reputable physician with whom he can agree in therapeutics; but when one general practitioner wants another practitioner, what is the use of having a consultation if they believe in such opposite directions that they can't get together so as to prescribe the same medicine? [1]

[1] "Among practitioners of the different schools consultations cannot be held, for the reason that there is a radical difference between them either as to the medicines to be used, or the manner of using them; hence, if the practitioners be honest in their several beliefs, no good can accrue to the patient, this being the sole object." — *McClelland on Civil Malpractice*, p. 15.

Now, doctors have their quarrels, a great many of them; they have very bitter feelings toward each other. One's enemy, as one conceives it, perhaps may be the person selected by the family to be called in consultation. One may expect, if such a person is called, severe criticism may be made, or the confidence of the family undermined; but if all parties would observe that rule laid down in one of the earlier treatises, "No man ought ever to go to a consultation who carries into it any of his private grievances, or who can see in it anything but the case of his patient," then we would have no trouble at all. Now, when does a doctor want a consultation to protect himself? In doubtful injuries; with ill-minded people, contentious people, people who are likely to make trouble, people who are never satisfied with anything that is done for them. The doctor soon estimates that class of people: he sees a great many of them; he can select them and differentiate them in about five minutes after he is called; — and that is the class against which he is very wary, and the class against which he seeks to protect himself.

Now let us consider one other thing. Don't call the consultant to such a job as this unless you warn him of what he is going to see. He is going to be in it as much as you; if there is to be a lawsuit the consultant can be sued as much as the attendant, and consequently it is not fair to lead him into this without giving him due warning; but no reputable man of good standing will refuse you in going to consult, or in going to help you in court, or to back you up, in any honorable way, in the profession. Doctors stand together very closely. Some one said to me once, that they never saw any Masonry like the Masonry of doctors. Doctors have to protect each other; not to the extent

of doing wrong, but to cover up any misfortune of their brethren so far as they can, in order that the general respectability of the profession be preserved. It is right that it should be so.

Now, doctors, as I say, hang together very closely, and there are certain ethical relations that they ought to adopt and preserve to retain each other's confidence and respect. We used to hear a good deal in old times about stealing patients; we don't hear so much about that nowadays, because the idea that any patient belongs to any doctor has long since ceased to exist, on account of the great number of specialists, and patients frequently pass from one doctor to another; and such a thing as a lifelong doctor seldom exists in the larger communities. What happens is this: the patients are variable; they wander about from person to person; and they think, unfortunately, that they have a good deal of medical knowledge which they do not have. They are taught by the newspapers and various forms of pernicious literature, that certain things are to be applied in certain cases, and they undertake to judge for themselves, generally coming to grief in consequence. Now I contend that the person who is constantly changing his doctor is very unhappy, just like a person changing his religion.

The class of things that doctors ought not to do towards each other are perhaps rather difficult to define; but they might be described as making remarks of a derogatory character, or innuendos, or insinuations, or inquiries in regard to a case in the hands of another physician, or the suggestion as to whether certain things have been tried. And, also, you should be very chary, I think, in showing too much attention to the patients of other doctors. Sometimes you get yourself considered very ill-natured and ill-bred on this account. Of

course, you ought to have a certain reservation about visiting people in a friendly way while they are under the care of other physicians. It might seem at first sight, that this is of no consequence; but when you consider it, it is. The doctor goes to see a friend who is sick and sits down and talks with him; naturally the patient leads the conversation to his own condition; he imagines or makes up something which he supposes the doctor has said, which reaches the ears of the attending physician and perhaps wounds him; consequently the wider you can keep from other people's patients while they are sick, the better for all concerned.

I conceive it to be the duty of the doctor as a professional man, to help to take care of the poor; and for his interest to do dispensary and hospital work whenever he can get an opportunity. In doing this I consider it his duty to teach, if any one comes and wants to be taught; in other words, the functions of dispensaries and hospitals are not simply to take care of the sick, but to spread medical knowledge. These are the great fields where experiment can be made, where aggregations of cases can be collected together, where statistics can be of some value, where patients are held down by stern laws and severe discipline, where their cases can be compared as they cannot be in private houses. While we should bear in mind that the first duty of the hospital is to take in the sick and injured and care for them, and try to make them well, there is another, and perhaps as noble a function — to extend medical knowledge, and also to allow others to derive benefit from it, and to learn, if they wish to come to the hospital and be taught. It seems to me that the physician who takes a hospital position and does nothing but make his visit and never makes it public to others does not fulfil his entire duty; for those who have any light in this

respect certainly ought to give it to others. It is thus only that students can learn; it is thus only that young physicians can learn; and, I venture to say, that you will find in hospitals a good many older physicians, who learn much from these larger fields of sickness.

The doctor, in his profession, loses much of the benefit of his calling and does wrong if he does not visit medical societies and associations. If he holds himself aloof from his fellows he gets to be regarded as a singular person, and he does not get along so well. The same duty that leads him to teach in hospitals should lead him to go to medical gatherings. They are of extreme importance; if possible, as much so as the hospital or dispensary.

To recapitulate, for a moment. We, then, should treat our patients always as our nearest friends; should preserve their secrets so far as the law will let us; should respect their confidence; should tell them the truth, unless it is going to injure them, and then should hesitate about telling them. We should, with our brother physicians, take extreme care in order that no suspicions may arise in their minds that we are suggesting anything in regard to their patients, or doing anything to make them lose their patients. We should never approach a consultation unless we can say fully that we have no feeling except for the best welfare of the patient. We should seek hospital positions because we can learn thereby; but having sought them, we should not hold them unless we are willing to teach, and impart some of that knowledge to others.

The doctor has certain duties which he owes to himself; and laying aside that very selfish mode of looking at the profession that we considered the other evening, still we must concede, even from a professional point of view, that

the doctor must be paid in order to get his living, in order to sustain himself at all; and it is a part of his duty and right to collect his bills. Here comes in the great difficulty of the sliding scale of which I spoke in the other lecture, which is absolutely necessary on account of the peculiar status of his patients — some being poor, some middle-class, some rich. No one price can apply to them all. They all may go to the grocer's, and pay the same price for a pound of sugar; but they cannot come to the doctor and pay the same price for medical attendance. The poor, being unable to pay for it, would be untreated, to the great injury of humanity. Consequently there must be a sliding scale from zero up; and a good deal of it must be zero. The doctor, in making out his bills and collecting them, must have regard to the circumstances of his patients; be just and merciful; but whereever people have any means, it is due to his self-respect to make some charge; and it is better for the patient as well as for the doctor.[1]

Questions frequently arise between physicians as to paying brother physicians for the care of themselves and families. It is the custom of doctors not to charge for such services; but it is the custom among some physicians, when a physician is called in, to arrange the matter by sending a present, or something of that kind. Others do not do so.

Now there arise many cases where doctors who are skilled in some special branch are called from a distance to see physicians' families, and thereby lose a great deal of time from their regular practice. When a person is a specialist he may be called away a half a day or a whole day from his business. It would be a great hardship if the doctor was obliged to

[1] Exorbitant fees injure the standing of the profession. Liberal fees, in consultation, are a protection to the attending physician. Small fees to the poor — but some fee — are the true course for the young doctor.

lose so much time without charge; consequently a rule was made that for visits to brother physicians which cost much time, one-half of the usual fee should be expected; and this seems to me very just.

Then, another rule in regard to the fees in visiting at a distance; and that is, that we should not charge by distance, but by time. Distance is not what it used to be: what takes now an hour used to take a day; if you can get an express train and can run over forty miles in an hour and come back in another, what is the difference whether you do that, or drive eight miles out of town for an hour, and come back in another hour? Consequently charges should be based on time rather than on distance, to a reasonable degree.

The doctor, unfortunately, is frequently the victim of suits for malpractice. He cannot afford to compound those felonies. What is it to compound a felony? If a thief steals your watch, you can advertise and offer a reward for its return, with no questions asked. A doctor cannot do that in a threatened lawsuit. The moment he does that he has lost his self-respect, and the respect of the community. If he is sued for malpractice he has got to fight, and fight it to the end. No suit for malpractice should be condoned or settled in any way, but should be fought out. As a rule, however long it is fought, the doctor will win his case. It is rare in Massachusetts that the jury will go against the doctor, in the long run, unless he proves to be a man of disreputable character. As a rule, the law is lenient, the law is just; and the interpretation put on it by most of our judges is rather on the side of the physician. It reads somewhat in this way; "The doctor is not obliged to be possessed of extraordinary skill; if it can be shown that he had ordinary skill, that he did his best to use the skill which he had, that the skill that

he used on his patient was what is averaged by the medical profession in his vicinity; if it can be proved that he did not neglect his patient, that he did the best he could, then he cannot be cast in damages in a suit for malpractice."[1] I have looked over the records very carefully, and the judges are uniformly fair, in their charges, to the doctor. Now, what brings these suits? Frequently surgical treatment, occasionally medical, more rarely obstetrical; but more frequently is

[1] "The law requires of a man who offers his services in any profession, three things: that reasonable degree of learning, skill and experience ordinarily possessed by others of his profession; reasonable and ordinary care in the treatment of the case committed to him; and the exercise of his best judgment in cases of doubt. . . . A physician does not engage to warrant and effect a perfect cure. . . . When the jury are satisfied of reasonable skill and care, that is sufficient." — *Sargent, J., Verdict for Defendant, McClelland,* pp. 32, 33.

"What constitutes *ordinary* or *reasonable* care or skill, and what is the proof of it? It is not easy to say. As much cannot be expected of physicians in remote localities, where they are cut off from opportunities of improvement, as from a physician living in a community where opportunity is afforded of seeing disease and accidents under more varied forms; nor from this class as from physicians connected with hospitals, or who reside in large cities. If it were otherwise we should find but a few physicians except in populous communities. The very favorable rule has been laid down in the law, that, the least amount of skill, therefore, with which a fair proportion of the practitioners of a given locality are endowed, is taken as the criterion by which to judge the physician's ability or skill." — *Bouvier's Inst.,* §§ 1004, 1005; *McClelland,* pp. 18, 19.

"He is not responsible in damages for want of success, unless it is shown to result from a want of ordinary skill and learning and such as is ordinarily possessed by others of his profession, or from want of ordinary care or attention. He is not presumed to engage for extraordinary skill nor for extraordinary care; nor can he be made responsible in damages for errors in judgment, or mere mistakes in matters of doubt or uncertainty." — *See J. Foster,* 460; 28 Maine, 97; 39 Maine, 155; *McClelland,* p. 43.

"The defendant is not liable for want of the highest degree of skill, but for ordinary skill." — *Seare vs. Prentice,* 8 East, 348; *Chitty on Contracts,* 165.

"And, of course, only for the want of ordinary care and ordinary judgment. The practice of surgery is indispensable to the community; and while damages should be paid for negligence and carelessness, surgeons should not be deterred from the pursuit of their profession by intemperate and extravagant verdicts. The compensation to surgeons in the country is small, in comparison with what is paid in cities for similar services; and an error of judgment is visited with a severe penalty, which takes from one a larger share of the surplus earnings of life." — *Wells, J., McClelland,* p. 260.

this the case in surgery, because surgery is tangible and can be seen. If a man has a bad limb or deformity, all his neighbors see it, and by and by some one says, "Why, that is not so good as mine, that is not so good as it ought to be"; or, worse still, some other doctor inadvertently says, "That is not a very good result." Immediately his mind is disturbed, and he brings suit against the doctor. In the present state of the law, we consider this a great hardship, even greater than being obliged to tell secrets in court. Under the present state of the law the poorest person can go to court to get justice against the doctor without having to possess one cent; he can get some counsel to undertake the case for the sake of the prospective fees, and consequently he can sue the doctor without money and without risk. Meanwhile the doctor cannot afford not to defend it, and to defend it by good counsel; he is very foolish if he has poor counsel. At the end of the suit he comes out triumphantly, but with a loss of several hundred dollars; while the only person on the other side who loses anything is the lawyer, who has taken it up for what he can get.

We are all liable to be sued on the slightest provocation, and we must defend it. We are not the only ones who suffer; if you look at the records for actions of tort, as they are called, you will see that the courts are loaded down with them. Corporations, municipalities, individuals, merchants, business men, contractors and employers, are constantly blackmailed in the most shameful way; many of these cases they settle without allowing them to go into court. So that our profession is not alone or peculiar in this respect; only it seems to us very hard, when we have done the best we could, that we should be for a long while kept in a state of uncertainty and forced to pay in the end, although we

get a verdict triumphantly in our favor. Now here comes in sometimes the importance of consultation, because if the patient has been seen in the beginning by other doctors; if they all agree; if they are sure what was the matter with him, and that what ought to have been done for him, was done, this would have great weight, and will possibly prevent a suit from being brought. That I have known to be so in some cases. But you cannot allow these suits to go without attending to them, because if a person yields to blackmail, all the hungry throng of sharks will mark him out as a prey, and he will have suit after suit brought against him, and soon will be entirely ruined. Moreover, on account of his self-respect he must stand for his rights. I do not think that any suit for malpractice will hurt a young doctor; in fact, sometimes it is an advertisement. It is not altogether an unmitigated hardship.[1]

We now have been over the principal points: first, with regard to medicine as a trade; second, with regard to the conduct of life in medicine as a profession. If the first lecture showed it to be pretty hard, still I trust that this lecture will show a better side. I have merely told you thus far how close you are to your patient, how near you are to the sympathies and the confidence of the community; but I have not pointed out to you that you will soon realize in practice how acute the pleasure is to you if you succeed in alleviating suffering, prolonging the patient's life, and, above all, seeing the scale turn and mount upward in a case of

[1] In England a Medical Defence Union is in vigorous existence. It assumes the risks of suits for malpractice and defends them. It is a mutual insurance company of medical men. Here, an attempt was made in 1895 to secure the assent of the Massachusetts Legislature to the establishment of a Medical and Surgical branch of the Employers' Liability Insurance Company. It failed, however. It is the opinion of some lawyers that the existence of such an association to defend the doctor would turn the jury against him.

acute disease. To see that is most intense pleasure; and a severe case of this kind, although you may not have a great many of them at once, will give you all you want to think of until the scale is turned. You will also find among human beings with regard to the doctor, not only some ingratitude, but gratitude and friendship which will come back to you year after year, which will do you good in ways which you have not thought of, which will make you feel happy, and make you think that something you have done is worth living for. Ours is the noblest profession that exists; it is, above all, the most humane; it cannot be otherwise; we seek daily, and give our lives, to make people happier, to make them better, to alleviate their sufferings in every possible way. This reacts upon us; we share their joy; and we frequently also get more credit than we deserve for unexpected results; and although sometimes we have a great many anxieties in the event of unexpected deaths, yet these are evenly balanced by seeing others convalesce.

If any one goes into the study of medicine as a business without a positive love for it, he will be greatly disappointed; and no matter how far he succeeds in later years, yet it will all be perfunctory and mechanical. Unless one has from beginning to end a love for the profession, and a love of science, that is the only thing that will sustain one in these anxieties and disappointments; and that is the only thing that will warm one and encourage one in lawsuits under unjust accusations. After having studied medicine a little while, we find out that either we love it, or we do not love it; yet the love of science for its own sake is so entracing and so charming, that it may beguile us on to where we shall afterwards love medicine.

There is nothing more delightful than the study of

medicine; it is very different from the practice of medicine. The study of medicine is one delight from beginning to end. You begin with anatomy, and what is more delightful than the study of that subject for a year or two, in which you can see almost every mechanical law and mechanical device demonstrated; then you pass on from that to physiology, and see all the most delicate functions; and when you go on still further and notice them in sickness, and can reason on the causes and conditions of disease far better than you could before, and then apply remedies that will regulate and give relief, what study is more delightful? The horizon of knowledge ever recedes. You are just as much a student when you are eighty years old as when you are twenty. Surgery lately has advanced so far and so fast that it has distanced medicine, and is now, since the application of antiseptics, the most attractive thing; and this, of course, is limitless; but meanwhile, even now at this moment and henceforward, I am sure that medicine is going to resume its own place, and by and by maintain its supremacy, which it always should have over surgery. I have always said that the physician is superior to the surgeon; that he has a broader field to look over; that his knowledge must be more extensive to make him a good physician than a good surgeon. Now the physician is coming back; and he is coming back through the great advances being made so rapidly through the discovery of the antitoxins and of bacteriology. In ten years, I will venture to say, that medicine will be on as high a plane as it ever was. The resources of our profession are endless in delight; and if you find in the beginning that you love it, you will never cease to be happy in its pursuit.

SHOCK.[1]

THE operative surgery of our time has annulled pain temporarily, arrested hæmorrhage permanently; averted septic absorption. It has not prevented shock. This is still a cause of much fatality. It is the object of this paper to inquire whether modern surgical procedure has *diminished* shock; wherein it fails to do so; and to suggest improvements of its defects.

What is shock?

When any one gropes his way in a dimly-lighted passage, and meets unexpectedly a strange person at some turning, he experiences a start, a mental apprehension, his heart turns over, flutters, but at once recovers its balance. Pursuing his path, if he now, in descending, misses a step in the dark, he has a greater shock to his nerves, he braces himself, flutters, sweats, or is chilled. If he falls and bruises himself moderately, he has vertigo, nausea, cold sweat, pain. If he falls and breaks open a joint, he has syncope, epileptiform convulsions, nausea, fluttering pulse, sweat, pain. If he injures himself more severely, he has unconsciousness.

This is a simple description of the degrees of shock: apprehension, fluttering, sweating, chilliness, pain, vertigo, nausea, faintness, convulsions, unconsciousness, collapse.

[1] Read before the American Surgical Association at the First Triennial Congress of American Physicians and Surgeons, at Washington, September 20, 1888.

The phenomena of a fainting-fit are the phenomena of shock. Sudden, disagreeable, painful, destructive impressions produced on the surface or efferent nerves, and affecting the brain; thence the ganglionic system; then the heart, the stomach, the skin; and thus the brain, at last.

Moderate shock terminates in reaction. This is the *recoil* of the system. It restores the balance; but the pendulum which marks the nervous force, swings back beyond the normal line. We have temporary fever, flush, full pulse, excitement.

Severe shock is more lasting. The pulse vibrates, intermits, flags, rallies, flags again, is soft, compressible, uncertain; faintness is constant, but partial; vomiting occurs; cold extremities; dilatable pupils; pallor; imperfect reaction; very slow recovery; a condition where a feather turns the scale against the patient.

If now an operation is done, we have renewed shock, prolonged shock, secondary shock; a matter of days rather than hours; persistent nausea; exhaustion; lowered temperature; diarrhœa; imperceptible and gentle death. Or, if an old person, that state known as prostration with excitement; typhoidal delirium, a dusky flush over the malar bones, dull eyes, intermittent pulse, jactitation, exhaustion, death.

Primary shock: reaction, early and perfect; or slow and imperfect. Secondary shock: prostration, nausea, excitement, collapse. Loss of blood, from accident or operation, adds to the shock or complicates its symptoms.

Jar, crushing, mutilation, pain, cutting, bleeding, chilling, all act on the nervous centre; react on the ganglia, the heart, the power of breathing, the temperature, the consciousness, the life.

Given then the problem and the phenomena of shock, what

particular influences have the operative procedures of *modern* surgery upon them?

They may be summed up in three points: the effects of anæsthetics, the effects of the operations, the effects of the dressings.

These all belong together and affect each other.

Anæsthetics annul pain, but end in nausea.

Operations under anæsthetics are needlessly prolonged and exhausting.

Modern dressings are tedious and chilling.

Have we lessened, or added to, shock by modern surgery?

Pain and bleeding are *less*. Slow cutting, nausea, exposure, low temperature are *more*. Primary shock is diminished; secondary shock is increased.

Formerly the time consumed in an operation was short. An amputation was hurried, now it is deliberate; an abscess was incised, now it is aspirated and curetted; a joint injury was cut off, now it is excised; the peritoneum was peeped into, now it is boldly explored; the bladder was cut for stone, now it is a prolonged crushing and washing; a breast was amputated, now the axilla is formally dissected. The old method was a matter of minutes, now it is one of hours.

Patients are frequently from one and a half to two hours on the operating table; and three hours in recovering consciousness so that they can swallow. Do we realize what this prolonged cutting, pinching and dissecting mean to the nervous system after anæsthesia is past? Does not the long exposure of the great veins to the air, in dissecting tumors, increase coagulability and future infarction? Can the peripheral nerves be lacerated *seriatim* without exhausting their constitutional irritability? It is recognized that long-

continued and large dissections on the front and sides of the neck are especially fatal.

Operations of *secondary* magnitude are now so prolonged that I have repeatedly seen patients die of primary shock, or *repeated shocks*, where the patient was one or two hours under the knife. It is said that he had not the vitality to resist. He had not; but consider what a perineal section, scooping out a uterine tumor, curetting a bladder, removing glandular enlargements, sometimes involve in time, in exhaustion, in capillary oozing, in shock.

Equally unphilosophical and fatal is the practice of operating in cases of primary shock before reaction has come on. An amputation is begun in half-life, and ended in death. Especially difficult to decide are the cases where the patient reacts imperfectly, and relapses. These cases are easily made fatal, and only saved by quick amputations, slight exposure and short anæsthesia. The golden moment of fairly established reaction must be seized, before traumatic fever sets in. This comes in from six to eighteen hours after the injury, or it never comes.

It should be considered an *axiom* that anæsthesia does not diminish existing shock, but only annuls the additional shock which the pain of cutting produces. It prevents the pain of an operation from increasing the shock which may be present from an injury. It prevents the pathological case from experiencing the shock produced by the pain of cutting out a tumor; it does *not* prevent the secondary shock of the mutilation; it adds to secondary shock if the anæsthesia is prolonged.

In feeble subjects the lack of nourishment which precedes an operation, desirable on account of safe anæsthesia, is much aggravated by their inability to retain food after the opera-

tion. This has an important influence in bringing about collapse.

Lowering of the bodily temperature is constant after an operation under anæsthesia. The thermometer frequently falls to 97°, to 96°, and after severe and prolonged operations, to 95° Fahr. This is a very serious matter, and has a marked influence in delaying reaction from shock. This chilling of the vital heat is induced, first, by anæsthesia, which, if prolonged, ends in a dripping sweat; next, by careless exposure during an operation. Then, also, it is largely due to antiseptic irrigations, to vapor douches of similar agents, to applications of cloths wet in corrosive or carbolic solutions around the site of the operation. The axillæ, the neck, the thorax and the abdomen are especially prone to deleterious chilling in this way.

Evaporation is a great factor in reducing heat; and this is constantly occurring on the body of the patient, in a warm atmosphere, during a prolonged operation. Especially is this dangerous when the peritoneal surfaces are exposed; evaporation then is very rapid and very extensive.

Warm douches and washes give as great a subsequent chilling as cold ones, as all experience who take a tepid bath.

The sufferer is frequently allowed to lie about too long, under an anæsthetic, waiting for his turn, in busy hospital practice.

The surgical toilette of wounds, in the modern modes of dressing, is depressing, exhausting, devitalizing.

Finally, comes the greatest evil of all, nausea. Nausea is one of the marked symptoms of severe shock, primary or secondary. Unfortunately, anæsthetics very frequently produce this as a secondary effect.

Persistent vomiting and retching mark the slow sinking and collapse of secondary shock after capital operations. Continued nausea is one of the worst of symptoms; begun in pain and shock, it recurs after anæsthesia, and continues as the most dangerous factor in preventing reaction.

What can we do to prevent or diminish shock?

(1) Wait for reaction.

(2) Never neglect to calm those suffering mental shock by a cheerful word and personal presence.

(3) Give alcohol, either spirits or wine, a quarter of an hour before the anæsthetic.

(4) Make the anæsthesia short; never begin it until everything is ready; suspend it during the less painful dressings. Consciousness returns *tardily.* We keep up the anæsthetic longer than is necessary.

(5) As rapid an operation as can prudently be done.

(6) As short a dressing as is practicable.

(7) As a cardinal point, avoid *chilling* the patient.

To promote reaction after the operation:

(1) Persistent and *carefully* applied *dry* heat. Be *over-careful* about accidental burns.

(2) Liquid nourishment, combined with a stimulant and a little laudanum, by enema.

(3) Subcutaneous injection of brandy.

(4) Aromatic spirits of ammonia by the mouth. Champagne is sometimes retained when other things are rejected.

(5) Black coffee and brandy, the stimulant *par excellence* when it can be retained on the stomach.

(6) Quiet: a horizontal or more than horizontal position; sleep; assurance that all is over, and doing well.

Modern surgery has won *three* great triumphs:

It substitutes sleep for pain.

It averts secondary hæmorrhage by the animal ligature.

It prevents fermentation by germicidal applications.

Can we add a *fourth*, by stilling the nervous system, and averting, or diminishing secondary shock?

THE FUTURE OF SURGERY WITHOUT LIMIT.

Fellows of the American Surgical Association:—

I believe that we are warranted in saying that the future of surgery is without limit. I deduce this conclusion, first, from considering what the mind of man has already done; second, from the future possibilities of fields hitherto unknown and unexplored, but now opening up to science. There can be but two limitations, either in the mind of man or in the subject.

Since the time when, in the anthropoid, the cerebral lobes first began to creep over and cover the cerebellum, what a growth has taken place in the penetrating power of the human senses. The brain has progressed from the rude hammer of the prognathous cave dweller to the telescope and the microscope. Originally of vision far less acute than the eagle's, the eye of man now ranges from the fixed star to the 20,000th of an inch bacteria. We analyze the sun's gases with the spectrum; we follow the magnet unerringly on the sea; we utilize the lightning; we count the vibrations of sound; we measure light; we speak across the ocean; we estimate the age of our planet; we analyze atoms; we compose new substances; we make pictures from light; we photograph and map the stars; we explore the pole and test the glacial history of the world; we find subterranean springs, and light our homes from old volcanic sources; we measure the crevasses in the glaciers of Mars; we count tides by the moon; we defy the wind with steam; we fore-

tell storms by the barometer; we construct isothermal lines; we inspect the bottom of the sea; we demonstrate eclipses; we measure space by the transit of Venus; we predict comets; we find a solar and a stellar unit of time; we unravel Egyptian chronology; we trace man downward through the stages of evolution. Man invents the wheel; the ship; the pendulum; the siphon. Under the water, in and on the earth; in the air; in the infinity of space; in the infinity of micro-organisms, — the mind finds no limit, but is ever restless, ever searching. And now in medicine averting pestilence; annulling pain; destroying sepsis; shall we stop?

In gradual development the brain of man has gone on step by step, investigating itself, until we localize disease by the tracings on cerebral surfaces, and condense in that wonderful cortical substance a palimpsest of impressions, mental and material. The brain studies itself. "Know thyself," said the Greek; and in searching the crypts of the human brain we may well echo the description of the greatest of the sons of men, "How noble in reason! How infinite in faculties! In apprehension, how like a god!"

We pass now to the second limitation, in the subject itself. Long since was it said that all was found out in anatomy, and that surgery had nearly reached its limit. Far from this, the microscope has created a new anatomy and a new pathology; physiology changes yearly; the lower animals yield light by the Baconian test of experiment. Anæsthesia enlarged surgery; antisepsis emboldens surgery; and we can set no limits to the advance.

The three sacred cavities: the abdomen, which means hidden; the thorax, which holds two feet of the tripod of life; the skull, which conceals the nerve force, the vital principle, all are explored.

Medicine, always obscure, is growing clearer; and instruments of precision have been applied to our art. The clinical thermometer is the telltale of internal changes, inflammatory or septic. What have we to fear? We advance haltingly, but we advance.

Specialism exhausts minute localities; by its occasional discoveries enlightens medicine; by its failure calls sometimes a halt. Specialism, tempered by general medicine, becomes a safe companion in our march onward.

It becomes us soberly to inquire how to study the new seats of surgical exploration. What new methods are needed? Where must we be conservative? Where can we be bold?

Since medicine is composed of a science and an art, we must study the science to develop the art. The four pure sciences are Anatomy, Physiology, Chemistry, Pathology. These purely scientific portions of our profession are the only ones that can yield positive knowledge, and this only by dissections, experiments and analyses.

Modern surgery deals with anatomical regions hitherto insufficiently studied. First, the *fasciæ;* the linings and bindings of the muscles, vessels and nerves have great influence in determining the course of suppuration and the size and locality of abscesses. A perfect dissection and preparation of the fasciæ does not exist. It is, perhaps, impossible to make it. Frozen sections and their photographs give the best idea of the relations of the fasciæ. Familiar instances of the importance of the arrangement of the fasciæ are to be found in the psoas sheath; the saphenous opening; the triangular ligament of the perineum; the deep cervical fascia; the fascia lata; the fascia of the forearm and the annular ligament; the posterior ligament or fascia of Winslow in the popliteal space.

Next, the topographical anatomy of the viscera, especially in the abdomen; not only the variations in the reflexion of the peritoneum, but the mobility of the organs; the rhythmic changes produced by respiration on the veins, on the diaphragm as an agent of displacement; and on the pelvic diaphragm, the perineum; the incessant movements of peristalsis and its power to change the locality of organs, —all these have not been sufficiently considered by the diagnostician and by the operator. Normal splanchnology and frozen sections of the abdominal cavity are of more worth to the student than the mnemonics of the origin of all the muscles and the twigs of all the arteries. The exact relations of the mediastina to the œsophagus, aorta, pericardium, and pleural cavities are of great importance also.

No less directly useful is an exhaustive and minute topography of the brain; the bearings of the falx, tentorium, corpus callosum, ventricles, the centre of decussating fibres; the ultimate origin of the fibres of the cranial nerves; the sinuses; the relations of the middle ear; the petrosal sinuses; the mastoid cells and their variations; the fissures of Sylvius and Rolando.

When we consider physiology we are struck both by its great progress and by its imperfections. The older physiology is obsolete and discarded; but in the newer physiology the functions of some large and important organs are still undetermined. The ductless glands, for instance; the spleen, the thyroid, the thymus, the supra-renal capsules. An ignorance of their functions renders the surgeon unable to predict the consequences of their removal. Of what avail the brilliant operation to excise a double goitre, if it is to be followed by an obscure degeneration of the nervous or

glandular systems? Again, in organs of known function, the limit of the digestive power of different portions of the alimentary canal is not yet definitely learned. How can we get along without a gall-bladder? How important is the pancreas? Can the duodenum supplant the stomach in nutrition? How much ileum can be removed without starvation? What will the rectum digest? All these are pertinent questions for the physiologist, and have a direct bearing on modern surgery.

In chemistry, the whole study of sepsis, antisepsis, fermentation, germicides, the viability of spores, is in its infancy; and as certainly as it already has reversed surgical practice, will do so again and again.

The great desideratum of surgery now, if chemistry can supply it, is a new, constant, local anæsthetic. This would enable us to banish a chief cause of secondary shock from our operations.

Finally, in pathology we have much to learn and to influence our surgical practice. Diseased organs change appearance and they change place. A double puzzle is thus presented to the operator. On opening the abdominal cavity we are sometimes at a loss to locate an organ; and even fail to recognize it, so changed is its look and its surroundings. One part is mistaken for another; a sac for intestine; intestine for sac; adhesions for peritoneum; and so in many other instances. It is of the last importance that the operating surgeon should be so familiar with pathological changes that he can distinguish the false from the true at a glance.

The future destiny of coarse pathological changes of organs: whether they are hopelessly diseased; whether they can recover; whether the affection is organic or inflam-

matory; is also to be decided, rightly or wrongly, by the surgical expert on a brief inspection.

Having considered how much we may learn or hope from the pure sciences, we pass to the other limitation of the subject, the arrest or the cure of morbid processes. All surgical disease is inflammatory or organic; we must advance by checking the inflammatory process, or by preventing morbid growths; the first, by averting suppuration; the second, by discovering the causes of cell change and cell proliferation. Through surgical pathology lies the only path. True conservative surgery would then be limited to averting the consequences of traumatism. The earlier labors of Paget, and the later ones of Virchow, Pasteur, and Koch, give us some hope of being able to abort suppuration; to inoculate for tubercle; or to eliminate the cancer cell. The abortion of inflammation is now much advanced by the progressing knowledge of asepsis. Pyæmia, the opprobrium of surgery, has been enormously reduced in frequency. When suppuration has occurred, evacuation, drainage, and antiseptics have been equally successful in shortening the pyogenic process and in promoting repair. In tubercle we see the best results follow the *évidement* of Sedillot, both in cancellous bone and in suppurating lymphatics.

As in variola, may we not hope that a modified germ may jugulate the tubercle bacillus, by inoculation? or if we meet not the success which the modification of rabies is slowly attaining, that chemistry may give us a reagent to devitalize the germ of tuberculosis?

Cancer, to include under that term all recurrent tumors, is, by Virchow's nomenclature, a misplaced cell-growth. Modern research now gives us hope of finding the cause of this mal-

development; and if a germ should be discovered here, a germicide will be finally found.

The manual part of our art, chirurgery — handcraft — requires also to be perfected in connection with the advancing boldness with which we open cavities and feel the pulse of life in its central shrine. New operations demand a new *technique;* new modes; new instruments; a new code of rules; all to be learned by experiment. Nowhere, perhaps, could the French saying, "jeun chirurgien, vieux médecin," be more applicable. It is to the young surgeon, born and bred in asepsis, that the older physician must look for progress in our art.

In estimating, then, the limitations of surgery, we find none except they be set by ourselves. How should they be set? By conservative judgment opposed to rashness. In the list of modern and useful operations, as distinguished from those barely justfiable, are the following:

(1) To remove growths or foreign bodies from the cavities of the body: opening the brain; opening the spinal cord; displacement of the upper jaw or of the nose for naso-pharyngeal polypi; cutting into the pharynx from outside the neck, to remove tumors of the tonsil; œsophagotomy for foreign bodies; thyrotomy for growths; gastrotomy for foreign bodies; opening the gall-bladder for the removal of stones; opening the pelvis of the kidney for calculi; suprapubic cystotomy for calculi and tumors of the bladder; ovariotomy; removal of the diseased uterus or its appendages; laparotomy for gunshot wounds and for extra-uterine fœtation; excision of the lower part of the rectum for growths.

(2) To reach and evacuate inflammatory products: opening the chest and resecting the ribs for empyæma; opening

the abdomen for appendicitis; or for chronic peritonitis; opening and drainage of pelvic abscesses; of abscess of the vertebræ; opening of deep abscess of the neck; evacuation of and draining abscesses of joints; perinephritic abscess and removal of one kidney.

(3) To relieve obstruction: intubation and tracheotomy; gastrotomy and enterostomy; colotomy; perineal section; herniotomy.

(4) To restore continuity: resection and suture of bowel; resection and union of bone; resection and reunion of nerves; nerve grafting; reunion of tendons and of muscles.

(5) Unclassified procedures: plastic and osteo-plastic surgery; modifications of orthopedics, including bone sections and excisions; litholapaxy; reduction of dislocation of the hip and of the shoulder, by applied anatomy; endoscopy; rhinoscopy and removal of turbinated outgrowths; pathology and removal of adenoids; aseptic wiring of fractures; local anæsthesia in setting fractures; closing of skull wounds by the insertion of buttons of bone.

(6) Operations as yet *sub judice*, or on trial: resection of the pylorus; resection of cancerous intestine or omentum; removal of the spleen; of large bronchoceles; of the larynx; the pancreas; the prostate gland; the normal ovary; fixation of the kidney or of the uterus; puncture of the pericardium; opening gangrenous abscesses in the lung; tapping the ventricles of the brain.

Rash statements are to be discounted; rash operations are to be discouraged. The wisdom of our earliest Greek master in analyzing the imperfections of our art holds true to-day: "Ars longa, vita brevis est; occasio fugax; experietia fallax; judicium difficile."

DOES MEDICINE ADVANCE?[1]

WHAT is the true object of the practice of medicine?

To prolong life; to relieve suffering; to prevent disease; to cure disease.

If we contrast the life of our day with the life of any previous period we can safely say that people live longer or have a chance to live longer; that pain is more remediable; that many diseases can be prevented, or avoided; but can we say that more sick people are cured?

Does medicine advance? The answer varies according to the four objects to be attained.

What has this century given us that is wholly new?

In 1840, the law of zymosis, or fermentation, by Dr. Farr.

In 1846, anæsthesia, by Dr. Morton.

In 1850, the demonstration of a bacillus (of anthrax) by Davaine and Rayer.

In 1858, the law that fermentation and putrefaction are due to micro-organisms, by Pasteur.

In 1865, antisepsis, by Lister.

Later the differentiation of germs by Koch; the cultivation of germs; the study of their noxious products or ptomaines; the antitoxins; the migration of the white cell, in inflammation; the leucocytosis of suppuration; the

[1] Annual Address delivered before the Medical and Chirurgical Faculty of Maryland.

functions of the elements of the blood; subcutaneous therapeusis; sanitary science; the conquest of epidemics.

Why lengthen the list? And all this in fifty-seven years.

Hippocrates advocated pure air, pure water and a pure soil, as the requisites of health. Now, we have learned why air may become impure; how water becomes infected with water-borne diseases; by what means to cleanse the soil.

Does medicine advance? Our medical ancestors based their practice on first, observation; second, experience. The modern physician relies on first, experiment; second, observation.

As the science of medicine advances thus, and thus only, may the art progress. What is the science of medicine? What does it grow from? Chemistry, anatomy, physiology, pathology, bacteriology. What constitutes the art of medicine? Therapeusis, chirurgery, obstetrics.

Who can question the advance of chemistry? of microscopic anatomy? of physiology by vivisection? of pathology and bacteriology, and the flood of light they shed upon the nature and the study of disease?

The Roman physician described the dates and the varieties, the *habitat* and the peculiarities of malarial diseases as accurately as we can now. The use of arsenic or the Jesuits' bark was well known to control them. But why some were quotidian, some tertian and some quartan, we were as ignorant of as the Roman, until the microscope discovered the germ of malaria in the blood, and showed that its periods of growth by fissure marked out the access of chill into one, three or four days' interval.

What are the eras of medicine? Observation, by Hippocrates; polypharmacy, by Galen; experiment, by Bacon and

Hunter; a reliance on nature, by Sydenham; the school of precision, by Louis; prevention, by Jenner; aggressive therapeusis, by modern scientists.

When men depend on observation, unaided by scientific instruments, they remain acute observers. The eye of the savage has a range of vision beyond that of the civilized man. The microscope enlarges our sight, but dulls the natural power. Hippocrates observed the phenomena of disease, and gained, probably, as good an idea of practical facts as we do now.

From Hippocrates to the Middle Ages and even later, the blood has been accused as being the focus of disease. Bleeding, *coup sur coup*, was supposed to eliminate the *materies morbi*, although the often irremediable loss of fibrin and red corpuscles was soon replaced by serum from the tissues. Now, transfusion of blood, or of salt solutions, indicates the turning of the scale upwards rather than downwards, and a new supply takes the place of depletion.

The modern study of the elements of the blood and the counting of corpuscles mark the change which the microscope has introduced into this part of our art. These are the greatest improvements since the demonstration of the circulation by Harvey.

Polypharmacy has had a long reign, and is still vigorous in its old age. Synthetical remedies supplied by modern chemistry tend to keep up the delusion that many drugs will do more than few, or none; and the search for specifics still continues.

Experiment, the *vexatio naturæ* of Bacon, introduced a great advance in medical practice. To Bacon is due the inductive method of reasoning. While the study of medicine is wholly by observation, the practice of medicine is the

esult of experiments. Medical science is then strictly inductive. But theories of medicine may lead to deductions, and often to false ones.

Observation is what we learn by using our senses. Experiment is the trial of anything. Induction is to generalize from observation and experiment. For example: Watt observed that boiling water turned into steam; that steam lifted the cover of a kettle; he experimented to see if it would move other objects; by induction he generalized the law of the expansion of steam. John Hunter was an earnest advocate of experiment. All theorists say to the practitioner at the bedside, "Do not try, but think, reason, deduce!" Empirical Hunter said, "Do not think, but try!" Pasteur and Koch, aided by vivisection, have carried experiment farther than its authors could have deemed possible.

Experimental physiology, by proving the effects of drugs on the lower animals, aided by experiments on the normal respiration, temperature and digestive powers of such animals, has enlarged the list of remedies, defined and limited their use. Chemistry, too, has rendered valuable aid in therapeusis by separating the cleanly and active alkaloid from the useless bulk of nauseous drugs.

A reliance on nature's restorative powers, advised by Sydenham, gave rise to the expectant treatment. To wait and watch; to do no harm, if no good; therapeutic nihilism were still more enforced by the teaching of the elder Bigelow on self-limited diseases. That disease was not an entity distinct from ordinary life, but a process capable of a spontaneous return to health, in time, and in a more or less certain time. Such doctrines, carried farther, considered disease a part of the plan of creation, as Cotting sug-

gested. "Natura duce" was the motto of the expectant school.

The natural history of disease and diagnosis assumed the chief importance. These were the prevailing methods when the writer entered the profession. Drugs were of doubtful utility; experiment was not stimulated by such doctrines. The medical atmosphere of those times was cloudy and not encouraging.

Now arose the school of precision headed by Louis and his statistical methods. Statistics have, however, been shown to be not free from fallacy. The personal equation of the observer is often fatal to the accuracy of statistics. The eye sees only that which it has the power of seeing. Previous knowledge and particular training, as well as common-sense, are necessary to the correct observation of any class of phenomena. We are the standard by which we must judge of external nature, and observation must always vary with the character of the observer.

Two instruments of precision had now appeared, and were destined henceforward to exercise the most important influence on medicine. One was the compound microscope; the other the clinical thermometer. The microscope revealed disease in the tissues; the thermometer measured accurately fever and chill. All doctors could learn the tongue; all could estimate the pulse; but bodily temperature has proved to be a more definite guide. The stethoscope, the laryngoscope, and, above all, the ophthalmoscope, displayed fields before unseen; and revealed changes which before must be guessed at.

Prevention of disease was a brilliant thought and a long stride forwards. To Jenner must be freely accorded the first successful attempt at prevention, by his discovery of

vaccination. Many others have followed with antitoxins, or serum-therapy, as Pasteur, Koch, Behring.

Prevention by sanitation, or hygiene, comes forward next into view. The pure air, water and soil of Hippocrates are again studied, and the most assured improvement in longevity has been brought about by purifying the air, filtering the water, and draining the soil. Freeing the food from adulteration and from the germs of disease is best exemplified in the case of the milk-supply and of pork.

All this is new. It was unheard of in the Middle Ages, and even later, when one disease, due to heat and over-crowding, arose, the sweating sickness, or miliary fever. This malady has disappeared under modern sanitation. It is, I believe, the only disease which has vanished out of human existence. All the other germs and poisons remain, even the bubonic plague of Thucidydes, Boccaccio and DeFoe.

The miliary fever raged epidemically. In this disease there was a natural sweat; and this was seized upon as the grand indication of treatment. Whoever, when seized, wished to escape death, must perspire for twenty-four hours, without intermission. Hecker, in his "Epidemics of the Middle Ages," thus states the treatment: "So they put the patients instantly to bed, covered them with feather beds and furs, and while the stove was heated to the utmost, closed the doors and windows with the greatest care, to prevent all access of cool air. In order, moreover, to prevent the sufferer, should he be impatient, from throwing off his load, some person in health likewise lay upon him, and oppressed him to such a degree that he could neither stir hand nor foot; and, finally, in this rehearsal of hell, being bathed in an agonizing sweat, he gave up

the ghost." This pestilence, miliary fever, visited almost every puerperal chamber, for there a like hot regimen was carried out.

Immunity now appears as a new treatment of disease. Syphilization, inoculation of rabies; of tetanus; of diphtheria. The last named, so general and so fatal a disease, that prevention, or abortive inoculation, has already secured a more brilliant success than any measure since the days of Jenner. Antisepsis and germicides also come in to play an extremely important rôle in sanitation.

Finally, aggressive therapeusis, as we will term it, has taken the place of expectancy. True, we will wait on nature, but we also attack disease. We explore the cell for the germ; we isolate, locate, abort, eliminate the germ, which is present in each malady, and which affects, if it does not wholly cause it. It is evident that chemistry and bacteriology must here do far more than drugs. We can destroy the vitality of the comma bacillus, the milk or water-borne typhoid germ, and the trichina of pork by simple heat. Other varieties we attack by chemical solvents, and by inoculations of their products in, so-called, antitoxins.

It is questionable, however, whether all our modern methods are sanative. Antifebrin, antipyrin, and the long list of febrifuges aim to reduce fever rapidly. On the other hand, nature's method is to cause first, perspiration, which may eliminate morbid elements; and, second, evaporation, which cools gradually. Some contend that fever is a germicide, and hence salutary; while the rapid reduction of temperature by the drugs alluded to is accompanied by depression of the heart and the vitality.

Can we cure more diseases? Let us take the five chief

causes of death in Boston in 1896. They were: pneumonia, 1,387 deaths; phthisis, 1,328 deaths; heart disease, 861 deaths; diarrhœal diseases, 713 deaths; diphtheria, 516 deaths; making a total of 4,805 deaths out of 11,634, the mortality of the city for that year; five-twelfths of all deaths, or nearly one-half.

Of these we shall find the curability of pneumonia not improved; of phthisis, improved; of diarrhœal diseases, much improved; of diphtheria, a mortality reduced from 40 per cent. to 12 per cent. Pneumonia has usually come second to phthisis in the number of deaths; but last year it exceeded it. There is, then, an advance in the frequency of pneumonia, but no advance in treatment. But when we find that heart disease comes next in the list of mortality, can we not safely infer that a weak heart, overloaded on its right side by lung obstruction, is the ultimate cause of many deaths from pneumonia?

The dead-line of pulmonary consumption is declining slowly; prevention is beginning to influence it. Tuberculin is a test, but not a remedy. Successful treatment depends on early diagnosis, climate, sanitation, isolation, destruction of sputa. Diarrhœal diseases, oftenest infantile, have been much aborted by sterilizing milk, and by a reconstruction of its ingredients, chemically. Diphtheria will be jugulated by antitoxin inoculation. It is safe to say that all this advance in reducing the mortality of phthisis, diarrhœal diseases and diphtheria has been made through bacteriology.

On organic diseases we have made no impression by medicine. They constitute about one-eighth of the general mortality. Very early diagnosis must here precede any effectual treatment. This treatment must be dietetic and

hygienic, rather than pharmacal, unless inoculation by some toxin shall be discovered.

In consequence of the reduction of zymotic diseases, many lives are saved in childhood. Thus it results, according to the British Health Reports, that up to twenty-six years the chance of life has increased. But after thirty years, by the same tables, the chance of life is less than it formerly was, owing to the increase of diseases of degeneration due to civilization. There is a notable increase of cancer, and of some other organic diseases. So many feeble lives, preserved through childhood, become feeble adults, prone to gradual decline. The percentage of chronic diseases is thus steadily increased.

It is thus seen to be impossible to overturn nature's balance of life and death. It is given to all men once to die. Mortality must come, or births would cease for want of food. Increased longevity and a diminished birth-rate meet in highly civilized communities. War, epidemics and famine play their part in restoring the disturbed balance of life and death; and they always will do so. It is for us to seek by prevention and sanitation to preserve the lives of those around us, well knowing that heredity and other causes will be always contending against us. In the midst of marvellous improvements and discoveries we must realize that the diseases which affect mankind have never died out; they are only held in abeyance.

Smallpox, cholera, plague, diphtheria, tuberculosis, cancer, are active and watchful enemies. That we have accomplished so much against them is surely cause for congratulation. Medicine, as an art, really advances. Meanwhile the horizon of knowledge is ever receding; and the field of new discovery and exploration is inexhaustible.

Shall we lie down in our defences in sullen and stubborn opposition? Or, shall we join the thin skirmish line of assailants which openly attacks the causes of disease by bold and repeated assaults?

The one is expectancy; the other is aggressive therapeusis.

THE PROFESSIONAL HORIZON.

Audi alteram partem.

The master mariner in olden times scanned the horizon, watched the currents, estimated the tides, studied the winds to guide the good ship on her course. All these were variable and changeable; but the magnetic needle, the sun, moon and stars were unvarying guides. So the modern steamship master may disregard the winds, surpass the tides, defy currents and storms; but yet he is always dependent on the compass, the quadrant, and his solar or stellar observations for his position, his progress, and his prospective voyage.

Thus, too, the older surgery, contending with obstacles and evading dangers, by its care and skill, although by devious routes, often landed its patient safe at last.

While modern methods, more rapid and direct, may lead straight on to recovery and to life, yet, although newer observations, newer science, newer instruments of precision, may modify and may advance modern surgery and medicine, the principles of the science and art remain the same as they were before; and, if disregarded, they lead to failures in practice, or at best to temporary success.

In scanning, like the old sailor, the professional horizon, may we not learn from the omens of storms or calms, where we have gone astray from the unerring guides of sound professional principles?

The unbalanced predominance of operative surgery has destroyed all natural and harmonious proportion between operations and surgery; and between surgery and medicine. Antisepsis has insured an immunity which over-emboldens the operator, and which substitutes the precipitate certainty of an incision for the well-considered conservatism of diagnosis and delay. No one can deny that anæsthesia first, and antisepsis next, have enormously increased the domain of operative surgery. No one can assert that much of this is not both useful and hopeful. And yet in proportion to other surgery, operations should fill a second place. The rare has become the common, and the common has been pushed aside and neglected. Contusions, abscesses, fractures, varicosities, atheroma, are the everyday things we always see; and abdominal diseases have usurped undue attention, and displaced the common classes of surgical events.

Diseases of the joints, affections of the lymphatic glands, maladies of the bones, ulcers, the endless variety of affections of the rectum in modern sedentary life, — these, like the poor patient, we have always with us. Such cases filled the text-books, and supplied a large part of the surgeon's practice. But to-day, if the student or practitioner opens the pages of the present surgical text-books, he finds that genito-urinary surgery and that of the abdomen and the brain occupy one-third of the space. Pages are devoted to the multiple and fancy stitching of an intestine, and a paragraph suffices for piles; yet one hundred people have piles, and require treatment from the surgeon, to one who has intestinal obstruction. The new is interesting, the new is important; but it is overdone. Perspective is lost; the natural proportions of classes of cases obscured. Rare things are magnified; common things are overlooked.

There is also constant danger of confounding functional and temporary with organic and permanent conditions: of operating for a symptom, and finding a phantom tumor. Visceral surgery replaces therapeusis. Forlorn hopes are common operations. Exploratory incisions made for diagnosis may be often innocuous where no disease is found, but are very fatal where organic and incurable affections exist. It used to be said that it was fatal to explore a tumor, outside the body, unless you could take it out. It is equally dangerous and often fatal to explore a visceral tumor, in spite of antisepsis.

Is there not danger, also, that the ease of looking breeds littleness of wit; that intuition, that sum of experience, may shrink and waste, when unused; that the balancing of chances, the estimating of probabilities, the struggle for a diagnosis, may be belittled in face of reputed certainties revealed by a cut, and thus delay sober judgment? Is not the therapeutic use of drugs also much unlearned by this fatal ease of operating? Obscure brain affections, nervous habits, apparently organic and incurable growths, sometimes yield to medicine, and escape the knife. We may not often thus succeed; but does not the fact that we do not try medication lead finally to a loss of knowledge as to the chances of a trial?

Specialties magnify regions, distort wider vision, focus the attention on a point and ignore a more important whole. A diathesis, a constitutional bent, often directs or influences the general progress of a disease. A symptom may be local, or general. If local, it is seen; if general, it may be easily overlooked. Habit may perpetuate an epileptic crisis in spite of the operative removal of the local cause of the aura. A vent boldly given to a subarachnoid hæmorrhage may not

prevent a fatal result due to the plugging of the nutrient vessels of the pia mater. Clots in the spinal canal may be absorbed sometimes, with less hazard than by removing the laminæ and uncovering the spinal cord.

The treatment of the diseases of women has become almost purely operative. Attention to constitutional treatment is thus easily diverted.

The sexual maniac is spayed, often without lasting relief. Pelvic cellulitis and peritonitis not very rarely are lighted up by hasty interferences with the interior of the uterus.

Life is occasionally shortened by too early removal of innocent growths about the ovaries and uterus. So intensely has the attention been called to the right iliac fossa, that an appendicitis is suspected in every colic; incisions are sometimes made before walling off has occurred; an organ removed which was the seat of only temporary catarrhal obstruction, and the adhesions of an excision substituted for the adhesions of a transient inflammation.

Is any incision harmless? Certainly it is not. A scar is left; sensibility is increased. If in the abdomen, the binding power of the fasciæ is weakened. Hernia may result; or, at any rate, prevention may require an abdominal supporter to be worn ever afterwards. In gunshot wounds of the intestines a certain percentage of cases may recover without operation. Extravasation may be prevented by the pouting of the mucous membrane through the perforation of the ball; and the latter may be discharged *per rectum*. Of course, the majority die. But so, unfortunately, do most of those operated on. The history of such cases is scanty, the pathology new, the results few. Let us by no means discourage research, experiment, or even operation; but let us make haste slowly.

In the charm of asepsis, in the ease of healing, in the painlessness of operations and of recoveries, we are apt to overlook that great factor, shock. The effect upon the nervous system of a disease, an injury, an operation, is hard to estimate. It often turns the scale against recovery. Especially about the neck; in the three great cavities of the body; in any operation on the extremities which approaches the centre, the results of prolonged and teasing operations are often fatal through profound and prolonged shock. It has been recently advanced that age makes little difference in the prognosis of an operation, — an opinion from which we absolutely differ. No one who has watched the old but has seen prolonged shock of the nervous system, and evidences of impaired mental activity, long subsequent to operations of even moderate severity.

The somewhat ungrateful task of advancing heretical opinions, in the preceding remarks, can be condoned only from our profound conviction that the operative *furor* of modern surgery is resulting in a serious detriment to the best qualities of sound diagnosis, sound pathology, and surgical therapeusis: to diagnosis, because we do not exhaust means of harmless research; to pathology, because we operate to know what is the matter, and not from proved pathological processes and results; to therapeusis, because we neglect much that can be accomplished by regimen, by rest, by sedatives, by alteratives and by time.

When we survey the medical horizon, we find equally great changes. That harmony of knowledge and character which made the general practitioner many-sided, but symmetrical, — "sapiens, teres, atque rotundus" (Horace); that self-reliance which equalized extremes, balanced chances, judged impartially, — have been sadly damaged by the fatal facility

of the habit of consultations and by the narrowing spirit of specialism.

A great ignorance of the simpler products and processes of pharmacy has accompanied as great a lack of careful study in therapeusis. The medicine is now made to hand for the doctor by steam and chemistry; and the useful combinations of older drugs are swept aside.

Bred myself in an era of therapeutic nihilism, experience has failed to confirm my unbelief. On the contrary, long trial has convinced me that we can accomplish much with a few, well-selected, familiar and potent remedies.

If the surgeon and physician have changed, the lay public has changed faster. Credulity is undiminished. Modern witchcraft rivals the older kind. Therapeutic nihilism has become a system and a school of medicine. Practice has lost its stability. Formerly there was a family physician, whose patients retained him as a familiar and much used fixture until he died. Now he shares a family with others; and he does not look on any person as his patient for life.

This is a greater loss to the community than to the doctor. We regret, but we yield to these revolutions.

Meanwhile should we take a depressing view of our professional future? By no means; for never was surgical and medical science so bold, so advancing, so successful. Never was the young doctor so well educated as now. Never had he so large a clinical experience before entering on practice.

Moreover, partly from this cause, and partly from the mutable character of modern society, the young physician or surgeon never succeeded so fast, as now.

The future is full of hope. Knowledge advances. Hygiene and preventive medicine prolong the average of

life. Zymotics are to be stamped out. Bacteriology is to revolutionize therapeusis.

We, who have once ploughed the land, look back across the furrows of time, and gather new hope, as we see the renewed greenness of the fields of science, cultivated as they have never been before.

Only would we insist on the caution begot of experience, on the value of the past.

Let us advance firmly and with a confident heart, still holding fast to that which is good. The magnet does not vibrate. The sun and stars are eternal in their courses. Nothing can deflect from his course him who studies, hopes, believes, works.